DOCUMENT RESUME

ED 254 393 SE 045 382

AUTHOR Wilson, Sandra Meacham; And Others
TITLE A Study of Math Achievement in Elementary Schools in the State of Washington.
INSTITUTION Gonzaga Univ., Spokane, Wash.
SPONS AGENCY School Information and Research Service, Olympia, Wash.
PUB DATE Dec 84
NOTE 101p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS Data Analysis; Educational Research; Elementary Education; *Elementary School Mathematics; *Mathematics Achievement; Mathematics Curriculum; *Mathematics Instruction; Surveys
IDENTIFIERS *Mathematics Education Research; *Washington

ABSTRACT

The purpose of this study was to: (1) describe how mathematics is being taught in elementary schools in the state of Washington; (2) identify variables that relate significantly to how mathematics is being taught; and (3) identify variables that relate significantly to mathematics achievement. A sample of approximately 206 elementary schools was selected; complete data were obtained from 135. Two survey instruments, one for teachers and one for principals, were developed to answer 10 research questions. Answers to the questions are discussed, and 11 conclusions presented, concerning: (1) student learning objective development; (2) instructional materials; (3) mathematics instruction; (4) teachers' perception of their students' abilities and achievement; (5) teachers' perception of mathematics; (6) teacher training; (7) relationship between grouping techniques and instruction; (8) relationship between teachers' perception of their students' abilities and instruction; (9) relationship between teachers' perception of achievement and socioeconomic status; (10) relationship between district size, instruction, and achievement; and (11) relationship between achievement and instruction. Implications for future research are also considered. Appendices contain the survey instruments, the plan for data analysis, and results for each question. (MNS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED254393

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
✓ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

A STUDY OF MATH ACHIEVEMENT

IN ELEMENTARY SCHOOLS IN THE STATE OF WASHINGTON

December 1984

A Study Funded in Part by the

School Information Research Service of Washington State

Submitted by: Sandra Meacham Wilson (Ph.D)
(Assistant Professor at
Gonzaga University)

Mary Jo Buckingham and
Beverly Coram
(Graduate Assistants in the
Doctoral Studies Program in
Educational Leadership at
Gonzaga University

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Sandra M. Wilson

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SE 045 382

TABLE OF CONTENTS

Page

Introduction..... 1

Purpose of Study..... 2

Methodology:

Sample Selection Procedures..... 4
Description of Instrumentation..... 5
Description of Data Collection Procedures..... 5
Data Analysis Procedures..... 6

A Description of the Schools Included in the Study..... 6

Results:

Research Question 1. How Are Math Curriculums Developed and Structured? 8

Research Question 2. How Are Students Being Instructed in Math? 10

Research Question 3. How Do Teachers Perceive the Ability Levels of Their Students? 13

Research Question 4. How Do Teachers Feel About Math? 14

Research Question 5. How Well Are Teachers Prepared to Teach Math? 16

Research Question 6. How Are Math Curriculums Being Implemented at the Building Level? 17

Research Question 7. What Are the Relationships Between Grouping Patterns, Perceived Student Ability, and Instructional Procedures" 17

Research Question 8. Is There a Significant Relationship Between SES and the 1984 State Fourth Grade Median Test Score in Math? 20

Table of Contents (cont'd)

		Page
Research Question 9.	Is There a Significant Difference Among Schools From Different Size Districts Relative to Curriculum Development, Math Instruction, and Math Achievement?	21
Research Question 10.	Is There a Significant Difference Between High and Low Achieving Schools Relative to Curriculum Development and Math Achievement?	24

Conclusions..... 27

Implications for Future Research..... 31

Appendices:

C. SPSS Data Plans

D. Tables Reporting Results for Research Question 1

E. Tables Reporting Results for Research Question 2

F. Tables Reporting Results Obtained for Research Question 3

G. Tables Reporting Results Obtained for Research Question 4

H. Tables Reporting Results Obtained for Research Question 5

I. Tables Reporting Results Obtained for Research Question 6

LIST OF TABLES

Table		Page
Table 1.	Number of Districts in Washington Above and Below the State Median Percentile Score in Fall 1982 (md=57%)	1
Table 2.	Distribution of Student Enrollment in Districts of Various Sizes in the State of Washington	4
Table 3.	An Overview of the Proportion of Students Enrolled in the Schools Selected for This Study	5
Table 4.	Numbers of Principal and Teacher Respondents	6
Table 5.	Math Median Percentile Scores for the Different Size Districts	6
Table 6.	Total SES Scores for Each District Size Category	7
Table 7.	A Ranked List Order of Methods Used to Measure Student Progress	11
Table 8.	The Number and Percent of Teachers Who Used Various Methods of Measurement for Grading and Diagnosing Students	11
Table 9.	Results Obtained for Frequency of Use of Instructional Activities	12
Table 10.	Significant Chi-Square Values for Frequency of Activities That Were Found to be Different for Primary vs Intermediate Grade Level Teachers	13
Table 11.	Results Obtained for Questions Relating to Teacher Attitudes Toward Math	15
Table 12.	Instructional Variables Significantly Related to Grouping Techniques (at alpha $\leq$ .05)	19
Table 13.	Significant Chi-Square Analyses for Variables That Relate to Size of District (at alpha level $\leq$ .05)	22
Table 14.	Significant ANOVA - Size	24
Table 15.	Significant Chi-Square Results Obtained Relating Math Achievement to Instruction Variables	25
Table 16.	Significant T-Test Values for Determining the Relationship Between Math Achievement and Math Instruction Variables	26

A STUDY OF MATH ACHIEVEMENT IN ELEMENTARY SCHOOLS

IN THE STATE OF WASHINGTON

Introduction

There has been a recent national concern regarding math achievement. One reason for this concern is the fear that today's children will not be adequately prepared to meet the demands of the future work world. Changes are taking place in America's industry and it is being questioned by many whether today's high school graduates are able to perform the math skills required to operate the various technological advances that have been and continue to be made (Brouillet, 1984; Carpenter, Corbitt, & Kepner, 1980; Education Commission of the States, 1982; NAEP, 1983).

Based on a report published by the Education Commission of the States (1980) and summarized by the National Assessment of Educational Progress in the Fall 1982 Newsletter, it appears that math skills are declining on a nationwide basis while the demand for higher math skills in society are increasing. The report states:

> In mathematics, over 90 percent of the 17 year olds could perform simple addition and 85-90 percent could complete simple subtraction. On problems requiring understanding of mathematical principles, performance dropped from 62 percent to 58 percent (down 4%) between 1973 and 1978; mathematical problem solving skills declined by four percent (from 33% to 29%) (p. 8).

A review of district results obtained from the State of Washington's fourth grade assessment of basic skills indicates Washington is not exempt from the problem of low math achievement. Since the onset of the statewide assessment of the basic skills, math scores have been consistently lower than reading, language arts, and spelling scores.

Math test results across the state also have included a wide range of percentile scores. Table 1 depicts the number of districts in the State of Washington that obtained median percentile scores 10 percent above and 10 percent below the State's median percentile score in 1982.

Table 1. Number of Districts in Washington Above and Below the State Median Percentile Score in Fall 1982 (md=57%)

District Size	Number Above	Range of Scores	Number Below	Range of Scores
50 or more students	16	67% to 81%	20	32% to 47%
Less than 50 students	12	57% to 80%	27	24% to 47%

A large number of districts scored above the State's median percentile by 10 percentile scores. However, there are more districts scoring at least 10 national percentile scores lower than the State's median score.

The wide range of scores (from 24% to 81%) not only affects the State's median percentile score, it also indicates a possible diversity in the content of math curriculums and/or methods used to teach math in schools within the State.

Purpose of the Study

The purposes of this study were:

1. To describe how math is being taught in elementary schools (grades 1-6) in the State of Washington;
2. To identify variables that relate significantly to how math is being taught; and,
3. To identify variables that relate significantly to math achievement.

Specific research questions to be answered by the study and corresponding variables to be described are listed below:

Figure 1. Research Questions and Corresponding Variables

Research Questions	Corresponding Variables
1. How are math curriculums developed and structured?	a. how SLOs are identified b. teacher involvement c. extent to which SLOs guide instruction d. level of specificity of SLOs e. sequence of SLOs across grade level f. minimum competencies per grade level g. how instructional material for math are selected h. involvement of teachers in selection process i. primary and supplemental instructional types of materials j. quality of materials
2. How are students being instructed in math?	a. time per day teaching math b. time of day math is taught c. grouping patterns d. number of students in math class e. remedial instruction provisions f. enrichment instruction provision g. use of estimation h. assessment of students' progress i. frequency various teaching activities occur

Research Questions and Corresponding Variables (cont'd)

Research Questions	Corresponding Variables
3. How do teachers perceive the ability levels of their students?	a. a perceived ability of students in math b. perceived achievement of students in math
4. How do teachers feel about math?	a. importance of math b. level of comfortableness c. parental support of math
5. How well are teachers prepared to teach math?	a. major and minor for BA b. number of classes taken in math as undergraduate c. number of math classes taken beyond baccalaureate d. number of methods classes in math taken as undergraduate e. perceived adequacy of preparation f. inservice in math
6. How are math curriculums being implemented at the building level?	a. mode of teaching math b. specialists in math c. inservice - staff development d. strength of math program e. use of test results
7. What are the relationships between grouping patterns, perceived student ability, and instructional procedures?	a. grouping patterns b. perceived abilities of students c. instructional methods used
8. Is there a significant relationship between Special Economic Status (SES) and 4th grade test results?	a. SES b. school md. percentile score
9. Is there a significant difference among schools from different size districts relative to curriculum development, math instruction, and math achievement?	See variables listed for Questions 1-5.
10. Is there a significant difference between high and low achieving schools relative to curriculum development and math instruction?	See variables listed for Questions 1-5.

Methodology

Survey methodologies were used to collect teacher and school data required to answer the research questions. Following is a description of the sample selection, instrumentation, data collection procedures, and data analyses procedures used for this study.

Sample Selection Procedures

Given the budget allocated for this study, it was necessary to limit the sample size to approximately 200 elementary schools. To compensate for this restriction of sample size, the decision was made to stratify the sample based on district size. It was reasoned that students in various sized districts may be exposed to different kinds of instruction in math resulting from differing district policy and procedures for curriculum and staff development. It also was reasoned that students enrolled in different sized districts may experience different environmental conditions.

Four district size categories were used for this study: 1) Size A included districts with enrollment ranging from 01 to 2000; 2) Size B included districts with enrollment ranging from 2001 to 7000; 3) Size C included districts with enrollment ranging from 7001 to 14,000; and, 4) Size d included districts with enrollment greater than 14,000. The Size A category was based on the State of Washington's definition of "second class" districts, which included districts with enrollment of 2000 or less. The remaining district size categories were established based on two techniques. First, a frequency distribution of district enrollments in the state was observed and categories were established where there seemed to be a natural break (e.g., there were few districts with enrollments between 6500 and 7000). Secondly, the researchers attempted to create size categories that represented an approximately equal proportion of students relative to the total state population.

The total number of students in each district size category and the proportion of students each size category represents of the total state population are presented in Table 2.

Table 2. Distribution of Student Enrollment in Districts of Various Sizes in the State of Washington

District Size Category	Total Number Students	Percent of Total State Enrollment
A	127,046	17.0%
B	206,703	27.7%
C	177,701	23.8%
D	232,932	31.4%
Total Number of Students in the state	744,382	

The 1982-1983 Washington State School Directory was used as a source for drawing the sample of elementary schools. Each elementary school included in the directory was numbered. A random numbers table was then used to select the schools. A total of 206 elementary schools were selected so that the proportion of student population of those sample schools within each category closely paralleled the state proportion as described in Table 2.

The proportion of students enrolled in the schools selected for each size category is presented in Table 3.

Table 3. An Overview of the Proportion of Students Enrolled in the Schools Selected for This Study

District Size Category	Total Number Schools	Total Number Students	Percent of Total Number Students
A	62	12,826	18.3%
B	49	19,261	27.55%
C	35	16,029	22.93%
D	60	21,788	31.17%

Description of Instrumentation

Two survey instruments were developed: one for teachers and the other for the principal of those schools selected. The surveys were designed to answer the research questions for this study. Both surveys were pilot tested and revised, based on pilot test results.

The teacher survey contained 51 questions - 39 of which were closed-ended in format. The pilot test indicated the time required to complete the teacher survey was from 10-15 minutes.

The principal survey contained 12 questions - four of which were open-ended and eight closed-ended. Appendix A contains a copy of both survey instruments.

Description of Data Collection Procedures

The district superintendent of those schools randomly selected for this study were contacted by phone to gain their permission for this survey to be conducted in their district. If the superintendent approved, he/she was sent a letter acknowledging their willingness to participate and a packet of surveys was sent to the building principal(s) in that district. The principal was asked, via a cover letter, to distribute the surveys to teachers of Grades 1-6 in their building, collect them after they had been completed, and send them en masse back to Gonzaga University. The number of teacher surveys sent to a school was based on the school's enrollment divided by twenty-five.

Data Analysis Procedures

Data were analyzed using Gonzaga University's Hewlett-Packard 3000 main frame computer. The Statistical Package for Social Sciences (SPSS) was used for data anlyses. Appendix B includes the SPSS data plans for analyzing the principal and teacher survey data.

A Description of the Schools Included in the Study

Limitations of the Study

Of the 206 schools selected, permission was gained for 159 schools to participate in the study. The primary reason for not participating, mentioned by district superintendents, was the lack of time on the part of the teachers in the district. Several districts had been inundated with other studies throughout the school year and felt the district could not agree to participate in another.

A total of 135 schools (85% of 159 and 65% of 206) completed and returned surveys. The number of principal and teacher respondents from each district-size category appears in Table 4.

Table 4. Numbers of Principal and Teacher Respondents

District Size Category	Number of Principals	Number of Teachers	Percent
A	40	243	24.3%
B	27	268	26.8%
C	20	258	25.8%
D	30	230	23.0%
TOTAL	117	999	

The overall 1984 state fourth grade total math median score for schools participating in this study was 57.21. The distribution of median scores by size of district is presented in Table 5.

Table 5. Math Median Percentile Scores for the Different Size Districts

District Size Category	Median Percentile Score
A (rural)	58.69
B	54.87
C	60.56
D (large)	55.08

A Social Economic Status (SES) score was created for each school. This score was computed by multiplying a numerical weight by the percent of their students/families who fell in each category of economic status (as perceived by the building principal) and summing the weighted products. The categories and corresponding weighted values are as follows:

Category	Weighted Values
Percent of children of	
1. professionals and managers (physicians, lawyers, engineers, and executives)	x 5
2. white collar workers other than above (proprietors, salespersons, clerks)	x 4
3. skilled workers (electricians, carpenters, factory workers)	x 3
4. unskilled workers (laborers, custodians, dishwashers)	x 2
5. unemployed, welfare, etc.	x 1

Total Score = Sum of Product Scores

The total SES scores for each district size category are presented in Table 6.

Table 6. Total SES Scores for Each District Size Category

District Size Category	Total SES Score
A (rural)	259.24
B	282.36
C	296.42
D (large)	280.44

An analysis of variance using size as the independent variable and Total SES as the dependent variable indicated there was no significant difference among the various size districts and their reported SES scores.

Results

This section presents a summary of results obtained for each research question to be answered by this study. Several tables presenting results obtained from survey item responses that relate to each research question are included in the appendices.

Inherent in survey research is the problem of potential invalidity of the research findings and conclusions. This invalidity stems from two sources. First, it is not likely that all subjects selected for a survey research project will agree to complete and return the survey form. Consequently, the researcher does not know if those who chose to not respond are of the same opinion as those who did respond.

The second source of invalidity involves the potential misinterpretation of survey items on the part of the respondents. Even though the survey forms used in this study were carefully pilot tested and revised, it became apparent to the researchers (based on written comments made by respondents) that some questions were not being interpreted in the same way as the researchers had intended. The reader must recognize these weaknesses and consider this type of research to be primarily exploratory, with the findings needing to be validated by further investigations.

Research Question 1. How Are Math Curriculums Developed and Structured?

Appendix C contains tables presenting responses to survey items relating to Research Question No. 1.

The majority of teachers (65%) reported their SLOs were developed through a district teacher curriculum committee. Only 34 percent of the teachers reported they were involved in the development process.

The teachers were asked to indicate the extent to which the district SLOs guide the instruction they provide their students. On a five (5) point scale where five (5) equalled "extensively" and one (1) equalled "not at all", the average score obtained was 3.69, which could be interpreted as being a "moderate" level of use.

The teachers were asked to provide an example of one SLO for their grade level that involved either addition, subtraction, multiplication, or division. These SLOs were rated by the researchers relative to the degree to which they were stated in specific terms. A three (3) point scale was used in this rating process where a one (1) equalled "very" specific and a three (3) equalled "not at all" specific. An example of an SLO stated in each of the different degrees of specificity follows:

Rating 1: The student will be able to add two 2-digit numbers with regrouping

Rating 2: The student will be able to add 2-digit numbers

Rating 3: The student will be able to add whole numbers

Seventy-one (71) percent of the 709 SLOs that appeared on the surveys returned were written in very specific terms. Only eight (8) percent of the SLOs were stated in general terms.

The teachers seemed to consider their SLOs to be fairly well sequenced across grade levels. On a five (5) point scale where five (5) equalled "very" sequenced and one (1) equalled "not at all" sequenced, the average response across grade levels was 4.15.

The majority of the teachers (67%) indicated there were minimum competencies specified for math for each elementary grade level.

Ninety-four (94) percent of the teacher respondents indicated they were using instructional materials in math that were selected by their district. The most common means used by districts to select instructional materials was through the district administration (64% of the teachers claimed the district administration selected the materials). Only 12 percent of the teachers indicated a teacher curriculum committee was used in the selection process. However, 30 percent of the teachers indicated they were involved in the selection process. This 30 percent level of involvement is similar to the 34 percent level of involvement reported for SLO development. Perhaps the district administrators involved teachers in a different way for development of SLOs than for the selection of instructional materials, even though about the same percent of teachers were involved in each process. A Chi-square analysis was performed to determine if there was a significant relationship between teacher participation in the SLO development process and participation in the process of selecting instructional materials. The calculated Chi-square value was 221.14 (significant at an alpha level $\leq .05$ with one degree of freedom). Teachers who were involved in the development of SLOs also were apt to be involved in the selection of the instructional materials.

The average number of years current instructional materials had been used was 4.81 years. The teachers were asked to indicate the kind of instructional materials they used and if they used these materials as a primary or supplemental source for instruction.

A Basal text was the type of instructional material used most often as a primary source (79% of the teachers across grade levels used a basal text). The second type of instructional material used by teachers as a primary source was a workbook (36% of the teachers reported they used this as a primary source). The two types of instructional materials used most often as a supplemental source were teacher made materials (69%) and skill sheets (64%). Several teachers also reported they used computer software (35%) and/or films (34%) as supplemental instructional sources. Chi-square analyses were performed to determine if there were significant differences between primary (grades 1-3) and intermediate (grades 4-6) grade level teachers regarding the type of materials they were using. Results of these analyses indicated no significant differences between these two groups of teachers.

The teachers were asked to rate the quality of the instructional materials they currently were implementing on five criteria using a five (5) point scale where five (5) equalled "excellent" and one (1) equalled "poor." The results obtained for the five criteria are as follows:

Teachers considered their instructional materials to be

1. a "good" match to their SLOs (the average score was 3.91);

2. "average" to "good" in application to real life (the average score was 3.47);

3. "good" relative to math concepts (the average score was 3.77);

4. "average" relative to problem solving (the average score was 3.18); and,

5. "good" relative to computation (the average score was 3.94).

Chi-square analyses revealed no significant differences between primary and intermediate grade level teachers relative to their perceived level of quality on these five criteria.

Research Question 2. How Are Students Being Instructed in Math?

Appendix D contains several tables that present response data for survey items relating to the instruction of math.

Based on the responses obtained, teachers spend on average 47.69 minutes per day teaching math (the average time spent preparing for a math lesson is 16.09 minutes). About half (57%) of the teachers teach in the morning. Chi-square analyses revealed no significant differences among primary and intermediate grade level teachers relative to the time spent on teaching and preparing math lessons.

The most commonly used grouping pattern used by teachers was a single large group (75% of teachers taught math in a single large group). Of those teachers teaching to a large group, 35 percent indicated their students had similar skill abilities and 40 percent indicated their students were of mixed skill abilities. Only four percent of the teachers indicated they used individualized instructional methods and 20 percent used small groups as a grouping pattern. If a teacher taught to smaller groups, the groups had a tendency to be of similar skill abilities (16% of the teacher reported they taught math to small groups of similar skills). Few teachers (13%) indicated they used a team teaching approach. Chi-square analyses revealed no significant differences among primary and intermediate grade level teachers relative to the grouping techniques used.

The majority of teacher respondents reported they were able to provide remedial instruction (90%) and enrichment activities (85%) to their students. However, there were several teacher comments made on the survey indicating they were not able to provide remedial and/or enrichment activities very often. This was the case for both primary and intermediate grade level teachers.

The majority of teachers (58%) seldom or never encouraged their students to use estimation or guessing when working math problems. A Chi-square analyses indicated there to be a significant difference between primary and intermediate grade level teachers relative to their use of estimating with intermediate grade level teachers being more apt to have their students use estimating than primary grade level teachers (Chi-square value = 73.84 with three degrees of freedom and alpha $\leq .05$).

About half of the teacher respondents (57%) indicated they would give credit to students for using the correct procedures for solving a math problem, even though they came up with the wrong answer. There was no difference between primary and intermediate grade level teachers regarding this variable.

A ranked list order of methods for measuring student progress was established based on the teachers' responses to a question asking them to identify the method(s) they used to measure student progress. The list apears in Table 7.

Table 7. A Ranked List Order of Methods Used to Measure Student Progress

Method	Percent of Teachers Who Use the Method
1. Daily work	92%
2. Test book tests	85%
3. Homework assignments	45%
4. Standardized norm referenced tests	30%
5. "Other"	28%
6. District developed tests	24%
7. Building level tests	8%

The most commonly mentioned method included in the "Other" category was teacher developed tests. Chi-square analyses were used to determine if there was a significant difference in the use of each measurement method between primary and intermediate grade level teachers. The results indicated there was no significant difference for methods except the use of homework assignments. This analysis revealed the intermediate grade level teachers to be more apt to use homework assignments as a means for measuring student progress than primary grade level teachers. (The Chi- square value = 80.47 with one degree of freedom at an alpha level $\leq$ .05.)

The amount of emphasis placed on the various methods for measuring student progress for the purpose of grading and diagnosing student progress is summarized in Table 8.

Table 8. The Number and Percent of Teachers Who Used Various Methods of Measurement for Grading and Diagnosing Students

Method	Grading Students	Diagnosing Students
	No. (%)	No. (%)
Standard norm referenced test	14 (1)	51 (5)
District developed test	44 (5)	47 (5)
Building developed test	8 (.9)	12 (1)
Textbook tests	329 (35)	206 (22)
Homework assignment	8 (.9)	17 (2)
Daily work	446 (48)	510 (55)
Other	79 (8)	85 (9)

Many teacher respondents (48%) indicated they used daily work as the primary means for determining their students' grades in math. The second most commonly employed method used for grading students was by a text book test (35%). The same was found for diagnosing students' abilities (55% of teachers used daily work and 22% used text book tests). There was no difference in the use of methods for grading and diagnosing students between primary and intermediate grade level teachers.

Teachers were asked to report the amount of time they spent using various teaching activities (using a six point scale where 5 = 4-5 times/wk; 4 = 2-3 times/wk; 3 = once/wk; 2 = once every two weeks; 1 = less than once every two weeks; and, 0 = do not use). Following is a list of activities that fell into various frequency categories (based on the overall average response obtained for each activity). Table 9 summarizes the data results for this survey question.

Table 9. Results Obtained for Frequency of Use of Instructional Activities

Activities Used About 2 - 3 Times Per Week	Activities Used About Once Per Week	Activities Used About Once Every Two Weeks	Activities Used Less Than Once Every Two Weeks
1. Students work math problems alone (mean = 4.65)	1. Teach problem solving skills (mean = 3.15)	1. Review homework assignments (mean = 2.46)	1. Students practice graphing skills (mean = 1.38)
2. Students practice computational skills (mean = 4.27)	2. Students practice or work story problems (mean = 3.01)	2. Assign homework for reinforcement (mean = 2.44)	2. Assign homework for concept discovery team (mean = .93)
3. Teach computational skills (mean = 4.14)	3. Use math games, puzzles, etc. (mean = 2.62)	3. Use peer-tutoring or teaching (mean = 2.37)	3. Use computers for math games (mean = .90)
4. Teach math concepts (mean = 3.95)		4. Use exploratory or hands-on materials to develop a concept (mean = 2.14)	4. Use computers to learn math concepts (mean = .59)
5. Drill basic facts (mean = 3.77)		5. Give unit or skill test (mean = 2.01)	5. Students use calculators (mean = .41)
6. Work problems on the board (mean = 3.53)		6. Students practice measurement skills (mean = 1.54)	6. Use computers for programming (mean = .39)

Activities that were used most often by teachers related to computational skills and/or math concepts. Activities relating to problem solving or story problems were used only about once a week. Many activities used less than once every two weeks involved the use of computers.

It is not surprising that the computers were not used frequently, as most teacher respondents (55%) reported they had access to a computer only in their building. Only 24 percent indicated they had computers in their classroom and 21 percent of the teachers reported they had no access to a computer.

Chi-square analayses identified several activities that varied in their frequency of use for primary and intermediate grade level teachers. Those activities for which a significant difference was found (at alpha level $\leq .05$ with four degrees of freedom) are reported in Table 10.

BEST COPY AVAILABLE

Table 10. Significant Chi-Square Values for Frequency of Activities That Were Found to be Different for Primary vs. Intermediate Grade Level Teachers*

Activity	Chi-Square Value	Groups with Highest Level of Use
1. Assign homework for reinforcement of skills	133.09	Intermediate
2. Assign homework for concept discovery	30.88	Intermediate
3. Review homework assignments	132.23	Intermediate
4. Teach math concepts	12.87	Intermediate
5. Use exploratory or hands-on materials	86.24	Primary
6. Use math games, puzzles, etc.	77.68	Primary
7. Drill basic facts	114.56	Primary
8. Students practice computation skills	16.20	Primary

*Only teachers who reported they used an activity to some extent were included in these analyses.

Few primary grade level teachers used homework for reinforcement of skills and for concept discovery, and few spent a great deal of time reviewing homework assignments. It should be noted that, even though the intermediate grade level teachers reportedly spent more time teaching math concepts, a fairly high amount of time also was spent by the primary grade level teachers. Likewise, although primary grade level teachers spent more time using exploratory materials, math games, drilling basic facts, and having students practice computational skills, the intermediate grade level teachers spent a fairly high amount of time on these activities as well.

Research Question 3. How Do Teachers Perceive The Ability Levels of Their Students?

Teachers were asked to indicate the percent of students who fell "well above average", "above average", "average", "below average", and "well below average" based on their perceptions of their students' math abilities and how well their students were achieving in math. A total score for each teacher was devised for perceived ability and achievement by multiplying each percent value by a weighted score. The weighted scores used are as follows:

% "well above average" x 5

% "above average" x 4

% "average" x 3

% "below average" x 2

% "well below average" x 1

The highest possible score that could be obtained for perceived ability and achievement was 500 (if all students were perceived to be "well above average"). The average ability score obtained across grade levels was 312.65. The average achievement score was 308.38. The achievement scores were consistently lower than the ability scores for each grade level teachers (i.e. teachers in general did not perceive their students to be working up to their ability). Independent t-test analyses were run to determine if there was a significant difference in teachers' perception of student abilities and achievement in math among the primary and intermediate grade level teachers. The results indicated there was no significant difference in teachers' perceptions of their students' abilities and achievement in math between primary and intermediate grade level teachers.

Research Question 4. How Do Teachers Feel About Math?

The teachers were asked to report the extent to which they agreed with 13 statements that related to the importance of math, their level of comfortableness in teaching math, and perceived parental support of math. Appendix E contains data obtained for teachers at each grade level for these 13 questions.

The results imply that teachers consider math to be very important and teachers feel comfortable teaching math; however, most teachers do not feel more comfortable teaching math than other subjects. Most teachers indicated they do not teach math in the same way they were taught math. Parents were perceived to consider math to be of value. (See Table 11)

Table 11. Results Obtained for Questions Relating to Teacher Attitudes Toward Math

Statement	*Average Response
Mathematics has contributed greatly to society.	3.68
Mathematics has contributed greatly to science and other fields of knowledge.	3.85
Mathematics helps develop a person's ability to think logically.	3.59
An understanding of mathematics is needed by artists and writers, as well as scientists.	3.30
I am comfortable teaching mathematics.	3.48
I teach mathematics in much the same way that mathematics was taught to me in elementary school.	2.20
Parents in this community value the study of mathematics.	3.14
I am comfortable adjusting the mathematics curriculum to meet the needs of more able students.	3.31
A person's career/vocational choices are influenced by their math achievement.	3.21
The majority of my students seem to enjoy learning math.	3.20
I feel comfortable teaching math concepts.	3.29
I feel comfortable teaching problem-solving in math.	3.21
I am more comfortable teaching mathematics than I am teaching other subjects.	2.59

*Based on a four point scale where 4 = strongly agree; 3 = agree; 2 = disagree; and 1 = strongly disagree.

Independent t-tests revealed no significant difference between primary and intermediate grade level teachers regarding their responses to these questions.

Research Question 5. How Well Are Teachers Prepared to Teach Math?

Several questions regarding teacher educational and professional experience were asked. Appendix F contains tables that display a summary of responses obtained for each question.

The average number of years that a teacher had been teaching elementary math was 12.52 years. Few teachers reported they had earned a major or a minor in either science or math for their bachelor's degree. Only five percent indicated they had majored in math or science and 11 percent indicated they had obtained a minor in math or science. The average number of undergraduate courses taken that related to math was 2.37. Of these courses, about 1.14 focused on methods for teaching math. A total of 183 (18%) teachers reported they had taken no courses in math in their undergraduate program. Few teacher respondents (23%) had earned a masters degree. The average number of courses taken at a graduate level that related to math was 1.29 courses.

Teachers were asked if they felt they had been prepared adqequately to teach math. Only 42% responded with a "yes" to this questions. Seven areas of training in math identified most often by teachers as being needed and the percent of teachers indicating a need for each training area are as follows:

1. remedial techniques (38%)
2. enrichment programs (37%)
3. Teaching problem solving (34%)
4. Using computers (32%)
5. Diagnosing students' math errors (27%)
6. Using logic and reasoning (25%)
7. Teaching math concepts (24%)

Half of the teacher respondents indicated they had attended a math workshop within the last five years.

Several Chi-square analyses were used to determine if there was a significant difference between primary and intermediate grade level teachers regarding the teacher preparation variables relating to Research Question 5. Significant differences were found only for three variables that related to areas of training perceived to be needed:

1. Using remedial techniques (Chi-square = 9.69 with one degree of freedom). Primary grade level teachers perceived this to be a greater need than did intermediate grade level teachers.
2. Using logic and reasoning (Chi-square = 5.57 with one degree of freedom). Intermediate grade level teachers perceived this to be a greater need than did primary grade level teachers.

3. Enrichment programs (Chi-square = 4.26 with one degree of freedom). Primary grade level teachers perceived this to be a greater need than did intermediate grade level teachers.

(See Appendix F for corresponding Chi-square tables)

Research Question 6. How Are Math Curriculums Being Implemented At The Building Level?

Appendix G contains several tables that describe responses obtained on the principal survey.

The most predominant mode of teaching math at the building level was self contained classroom teaching (80% of the principals reported this mode to be employed). Seventy-eight (78) percent of the principals indicated they did not have access to a math specialist in the building.

Only 26 percent of the principal respondents indicated their teachers had continual access to inservice and staff development in math; and, only 37 percent reported their teachers had received a district-wide workshop in math within the last three years.

Most principals (72%) considered their math curriculum to be about the same in strength as other curriculum areas; 17 percent considered their math program to be of greater strength than other curriculum areas; and, 10 percent considered math to be weaker than other curriculum areas.

A total of 56 percent of the principals indicated they used a standardized test administered only at a district level to measure their student progress in math; 17 percent used a standarized test administered only at the building level; and, 26 percent reported they used standardized tests administered at both the district and building level. (It is not clear if the same test used at the district level also was used at the building level.)

The most common use of standardized test results in math was to inform parents how well a child was achieving. The average extent to which test data were used for this function was 3.65 (based on a five point scale where 5 = "extremely used" and 1 = "do not used at all"). The second most common use of standardized test results in math was to identify needed changes in math instruction (the mean score was 3.48 based on this same five point scale). There was little use of standardized test scores for the purpose of identifying topics for math inservice or workshops (the mean score was 1.95 based on the same five point scale).

Research Question 7. What Are the Relationships Between Grouping Patterns, Perceived Student Ability, and Instructional Procedures?

Several Chi-square analyses were computed to determine the relationship between methods teachers used to group students and different instructional variables that were measured on a nominal level of measurement. Because two grouping methods, using small groups with mixed skills and individualized instruction, were used by few teachers, they were not included in the Chi-square analyses (these two techniques would have resulted in certain cell sizes being too small to accurately estimate the relationship). Consequently, the grouping techniques included in these Chi-square analyses were: 1) small groups, similar skill levels; 2) large group, similar skill levels; and 3) large group, varied skill levels.

In addition, certain instructional variables were recoded for these analyses to assure appropriate cell size values for accurate interpretation of the results. The variables that were recoded and corresponding categories established are as follows:

Variable	Initial Categories	Modified Categories
1. The extent to which teachers encourage students to use estimation and guessing	4 point scale: 4 = almost always 3 = frequently 2 = seldom 1 = never	2 point scale: 1 = almost always & frequently 2 = seldom or never
2. Questions on degree of perceived quality of instructional materials	5 point scale: 5 = excellent 4 = good 3 = average 2 = below average 1 = poor	2 point scale: 1 = good to excellent 2 = below average to poor
3. Questions on amount of time spent on various instructional activities	6 point scale: 5 = 4-5 times/wk 4 = 2-3 times/wk 3 = once/week 2 = once/two weeks 1 = less than once every two weeks 0 = do not use	4 point scale: 3 = 2-5 times/wk 2 = once every two weeks to once/wk 1 = less than once every two weeks 0 = do not use
4. Questions on teacher attitude toward math	4 point scale: 4 = SA 3 = A 2 = D 1 = SD	2 point scale: 1 = disagree 2 = agree

The instructional variables found to be significantly related to grouping techniques are presented in Table 12. (Appendix H contains corresponding Chi-square tables.)

Table 12. Instructional Variables Significantly Related to Grouping Techniques (at alpha $\leq$ .05)

Instructional Variable	df	x^2	Grouping Technique Most Commonly Used
1. The use of standardized tests	2	13.98	Small groups, similar skills
2. The use of homework assignments to measure student progress	2	11.01	Small groups, similar skills
3. Whether or not teachers use enrichment activities	2	12.77	Small groups, similar skills
4. Whether teachers use team teaching	2	40.29	Large groups, similar skills
5. How teachers use skill sheets in the classroom	4	11.95	Large groups, similar skills
6. How comfortable teachers feel in adjusting the mathematics curriculum to meet the needs of more able students	2	7.67	Large groups, similar skills and small groups, similar skills
7. The frequency that homework is assigned for concept discovery	6	15.11	Small groups, similar skills
8. The frequency that teachers drill basic math facts	6	23.63	Large groups, similar skills and large group, varied skills
9. The frequency that computers are used to learn math concepts	6	12.66	Small groups, similar skills

Teachers teaching small groups with similar skill abilities were more likely to use standardized test scores and homework assignments as means for measuring student progress than teachers using large group instructional methods.

Teachers teaching small groups with similar skill abilities were more likely to use enrichment activities than teachers teaching to a single large group of students.

Team teaching was most likely to occur among teachers teaching a large group with similar math abilities.

Although the majority of teachers in all three grouping categories were likely to use skill sheets as a supplemental instructional source, a significantly larger proportion of teachers teaching to a single large group of students with similar skills were likely to use skill sheets as a primary instructional source.

Although most teachers in each grouping category felt comfortable adjusting the curriculum to meet students' needs, a significantly higher proportion of teachers teaching to a single large group of students with varied skills did not feel comfortable adjusting the curriculum compared to teachers using the other two grouping methods.

Most teachers in every grouping category indicated they did not use homework as a means for concept discovery; however, a higher proportion of teachers teaching small groups of students with similar skill abilities or a large group with similar skills were likely to assign homework for concept discovery than teachers teaching a large group of students with varied skill abilities.

Most teachers reported they would spend time drilling the basic facts; however, more teachers teaching small groups with similar skills indicated they did not drill basic facts at all compared to teachers teaching a single large group of students with either similar or varied skill abilities.

Teachers teaching small groups of students with similar skills were more likely to use computers for learning math concepts than teachers teaching a single large group of students with either similar or varied skill abilities.

Several one-way analysis of variance (ANOVA) computations were executed to determine the relationships between grouping techniques and instructional variables measured on an interval or ratio level of measurement. None of these analyses were found to be statistically significant (using an alpha level = .05).

A one-way ANOVA also was used to measure the relationship between grouping techniques used and the teachers' perceptions of their students' abilities in math. No significant relationship was found (at an alpha level = .05).

Research Question 8. Is There a Significant Relationship Between SES and the 1984 State Fourth Grade Median Test Score in Math?

The principals were asked to identify the approximate percent of their student population whose parents' employment status fell in various categories:

Category

Children of

1. professionals and managers (physicians, lawyers, engineers, and executives)
2. white collar workers other than above (proprietors, salespersons, clerks)
3. skilled workers (electricians, carpenters, factory workers)
4. unskilled workers (laborers, custodians, dishwashers)
5. unemployed, welfare, etc.

A total SES score for each school was calculated by multiplying each percent value by a weighted value for each category:

Category 1 percent was multiplied by 5
Category 2 percent was multiplied by 4
Category 3 percent was multiplied by 3
Category 4 percent was multiplied by 2
Category 5 percent was multiplied by 1

These product values were then summed to obtain the total SES score. The highest SES score that could be earned was 500 (if 100% of the parents fell in Category 1) and the lowest 100 (if 100% of the parents fell in Category 5).

The overall average SES score obtained was 276.36. A Pearson-correlation coefficient was calculated to determine the extent to which the SES score correlated with the 1984 median fourth grade test score obtained for a building. The resulting coefficient value was $r = .28$. Although this correlation coefficient value is significantly different from zero (at alpha $< .05$), this relationship can be described as being a low positive correlation (Hinkle, et al 1979).

Research Question 9. Is There a Significant Difference Among Schools From Different Size Districts Relative to Curriculum Development, Math Instruction, and Math Achievement?

Several Chi-square analyses were computed to determine the relationship between size of district and variables measured on a nominal level of measurement. The size categories used in these analyses were:

Size A - less than 2,000 students
(the average number of students was 581)

Size B - from 2,001 to 7,000 students
(the average number of students was 4,033)

Size C - from 7,001 to 14,000 students
(the average number of students was 10,627)

Size D - over 14,000 students
(the average number of students was 27,140)

Table 13 presents those variables that were found to be significantly related to district size. (Appendix I includes the Chi-square analyses tables relating to these analyses.)

Table 13. Significant Chi-square Analyses for Variables That Relate to Size of District (at alpha level $\leq .05$)

	Variable	df	x^2
1.	Methods used to develop SLOs	9	194.58
2.	Methods used for selecting math instructional materials	9	129.13
3.	Whether a teacher was involved in developing SLOs	3	180.43
4.	Whether a teacher was involved in the selection of the instructional materials	3	103.44
4.	Perceptions regarding the match of SLOs to instructional materials	3	8.21
6.	Perceptions of the quality of the instructional materials relative to problem solving	3	8.89
7.	Perceptions of the quality of the instructional materials relative to computation	3	9.37
8.	Use of computers for math games	9	31.83
9.	Availability of a computer to teachers	6	12.51
10.	Use of standardized tests for measuring student progress	3	22.05
11.	Use of district-developed tests for measuring student progress	3	59.14
12.	Use of building-developed tests for measuring student progress	3	9.49
13.	Use of text book tests for measuring student progress	3	13.53
14.	Use of homework assignments for measuring student progress	3	8.23
15.	Whether or not teachers have attended a math workshop within the last five years	3	18.76
16.	Whether or not a teacher minored in math or science for undergraduate program	3	9.22
17.	Whether the teachers taught in a high achieving or low achieving school	3	58.34

The most common means employed by districts in all size categories to develop SLOs and select math instructional materials was through a district teacher curriculum committee (based on the teachers' perceptions). However, there was a substantially larger proportion of teachers in small size districts (Size A) who reported that either individual teachers or building level teams made recommendations to the building or district administration for SLO development and instructional material selection than the proportion of teachers in the other three district size categories who reported they used these two methods. Also, there was a significantly larger proportion of teachers in the very large districts (Size D) who reported the SLOs were developed and instructional materials were selected by the district administration compared to the proportion of teachers in the other size categories.

It appears that as the district size increases there is a decrease in the proportion of teachers involved in the development of SLOs or the selection of math instructional materials. These findings are not surprising as the larger a district the fewer (proportionate-wise) the teachers who are likely to be actively involved in these processes, due to difficulties in attempting to complete a task (such as SLO development and/or selection of instructional materials) working with very large numbers of teachers.

The majority of teachers in every size district considered the instructional materials they used to be a good match to their SLOs; however, there was a larger proportion of teachers of Size B and D districts who did not consider these to be a good match. There were also larger proportions of teachers in Size B and C district size categories who considered the instructional materials to be below average in quality regarding problem solving. A larger proportion of teachers in the Size A category were more likely to consider their instructional materials to be good to excellent relative to computation skills than the proportion of teachers in the other categories.

Although most teachers in all district size categories reported they did not use the computer for math games, there was a higher proportion of teachers in the district Size C category who used the computer once a week to once every two weeks in the classroom, compared to the proportion of teachers in the other district size categories. There were also more teachers in district Size C reporting they had access to a computer in their classroom. Teachers in Size D districts were less likely to have access to a computer in their classroom than teachers in the other size districts.

Teachers in Size A schools were more likely to use standardized tests, building-developed tests, and text book tests for assessing student progress than teachers in the other size districts. Teachers in Size C districts were more likely not to use standardized tests to measure student progress compared to teachers in other size districts; and, teachers in Size D districts were more likely to use homework assignments to measure student progress compared to teachers in other size districts.

Teachers in Size C and D districts were more likely to have attended a workshop on math within the last five years than teachers in the other size districts. Teachers in the Size D districts were more likely to have earned at least a minor in math or science compared to teachers in the other size districts.

A Chi-square analysis was performed to determine if there was a significant relationship between level of school achievement (high achieving schools and low achieving schools - see Paragraph 5 below for a description of how schools were categorized for this analysis). There was a higher proportion of schools in the Size A and Size C districts that were among the high achieving schools compared to the proportion of schools in the Size B and Size D Districts.

Several ANOVAs were computed to determine the relationship between district size and variables measured on an interval or ratio level of measurement. See Table 14.

Table 14. Significant ANOVA - Size

Variable	Source of Variance	df	Mean Squares	F Ratio
Teachers' perception of students' abilities	Between	3	99854.26	2.74
	Within	930	36491.28	
Number of years teachers have taught elementary math	Between	3	552.30	11.21
	Within	948	49.28	

An ANOVA indicated there was a significant difference in teachers' perception of their students' abilities among the district size categories. The mean ability score for each district size is as follows: Size A = 316.17; Size B = 303.29; Size C = 316.33; and, Size D = 315.67. Scheffe post hoc analyses were performed to determine which of the four ability scores were significantly different; however, due to the conservativeness of this test, no significant differences could be detected.

ANOVA indicated a significant difference among the various size districts regarding the number of years teachers had taught elementary math ($F = 11.21$ with 3/949 df at $p < .05$). The mean number of years of teaching reported for each district size follows: Size A = 11.23 years; Size B = 11.71; Size C = 12.66; and, Size D = 14.75. Scheffe post hoc analyses identified a significant difference in the mean number of years between Size A and Size D districts and between Size B and Size D districts.

Research Question 10. Is There a Significant Difference Between High and Low Achieving Schools Relative to Curriculum Development and Math Instruction?

To answer this research question, the researchers had to determine what schools were to be in the "high" achieving group and which were to be in the "low" achieving group. The decision to place a school in a high or low group was based on 1) their math score for the 1984 statewide testing reported by the principal and 2) whether the principals considered the score to be "about the same as" math achievement scores for the other grade levels. Unfortunately, not all principals chose to report their math scores. Math scores were reported for only 100 of the 135 schools from which surveys were returned.

Thirty-three of these 100 schools were selected to be included in the analyses. The low achieving group of schools (N = 15) included schools with a reported math percentile score that was less than 53 and that was "the same as" or "above" math scores that were usually obtained for other grade levels in that building. The

high achieving group of schools (N = 18) included schools with a reported math percentile score that was greater than 63 and that was "the same as" or "below" math scores that were usually obtained for other grade levels in that building.

Chi-square analyses were computed to determine the relationship between math achievement, curriculum development variables, and instructional variables measured on a nominal scale. No significant relationships were found between level of achievement and curriculum development variables. Reported in Table 15 are the significant Chi-square values obtained for analyses of instructional variables (at alpha < .05). (See Appendix J for more detailed Chi-square tables).

Table 15. Significant Chi-square Results Obtained Relating Math Achievement to Instruction Variables

Instructional Variable	df	x^2
1. Grouping of students for teaching	2	7.38
2. The use of standardized tests for measuring student progress	1	11.59
3. Use of homework assignments for	1	4.58

A significantly larger proportion of teachers in the high achieving schools taught math to a larger group of students with mixed skill abilities than the proportion of teachers who used this grouping technique in the low achieving schools. Teachers in the low achieving schools were most likely to teach math to a larger group of students with similar skills.

Teachers in the high achieving schools were more likely to use standardized tests to measure student progress than teachers in the low achieving schools.

Teachers in the low achieving schools were more likely to use homework assignments to measure student progress than teachers in the high achieving schools.

Independent t-tests were used to measure the relationship between math achievement and variables measured on an interval or ratio level of measurement. Table 16 presents the t-values that were significant (at an alpha level < .05).

Table 16. Significant T-Test Values for Determining the Relationship Between Math Achievement and Math Instruction Variables

Variable	Group	Mean Scores	df	t-value
1. The time spent on instruction	Low	45.59	310	2.37
	High	49.44		
2. The number of years a teacher has taught elementary math	Low	11.36	300	2.31
	High	13.22		
3. Teachers' perceived ability of students	Low	305.78	305	2.69
	High	322.55		
4. Teachers' perceived achievement of students	Low	292.55	258	3.96
	High	321.70		

There was a significant difference between high and low achieving schools relative to the average time spent per day on instruction. More time was spent teaching math in the high achieving schools (49.44) than the low achieving schools (45.59).

Teachers in the high achieving schools had more years of teaching experience on average (13.22) than low achieving schools (11.36).

Teachers in the high achieving schools had a significantly higher perception of their students' abilities in math (322.55) than teachers in the low achieving schools (305.78). Teachers in high achieving schools also perceived their student had a higher level of achievement in math (321.70) than the perceived level of student achievement on the part of teachers in the lower achieving schools (292.55). The difference in the average student ability score and the average achievement score for the low and high achieving groups is much greater for the low achieving schools (a difference of 13.23) than for the high achieving school (a difference of .85). Although both the high and low achieving schools perceived student achievement to be lower than student abilities, teachers in the high achieving schools considered their students to be working more up to their abilities than did teachers in the low achieving schools.

Conclusions

The reader is reminded of the limitations presented with survey research. The conclusions are limited to the teachers and principals who chose to respond to the survey; and, given only 65 percent of the survey packets were returned, the conclusions can be generalized only to those teachers in the State of Washington who chose to respond to the survey. This research was designed to be exploratory, and it was recognized that the findings obtained would need to be substantiated by further research.

The following conclusions are based on the results presented in the previous section of this report. The conclusions have been divided into eleven major headings.

1. SLO DEVELOPMENT

   A. SLOs have been developed primarily through a district teacher committee. Thirty-four percent of the teacher respondents were involved in the development process.

   B. Most SLOs are written in very specific terms, such as "The student will be able to add two 2-digit numbers with regrouping."

   C. The SLOs are considered to be fairly well sequenced across grade levels.

   D. Most teachers indicated there are minimum competencies identified for their grade level.

   E. The SLOs are used only moderately to guide instruction.

2. INSTRUCTIONAL MATERIALS

   A. Instructional materials used tend to be selected for overall district use. The district administration is most likely to select the materials; however, 30 percent of the teacher respondents indicated they were involved in some way with the selection of the instructional materials they now use.

   B. A Basal text and workbook are the most often mentioned type of instruction materials used as a primary source of instruction. Teacher-made materials and skill sheets are used most often as supplemental sources of instruction.

   C. Teachers consider their instructional materials to be "good" relative to their match to the district SLOs, instructional materials for teaching math concepts, and computation; "average" to "good" relative to relating math to the "real life"; and, "average" relative to teaching problem solving.

3. MATH INSTRUCTION

   A. Math is taught approximately 47.65 minutes per day. Time teachers spend preparing for a math lesson is 16.09 minutes.

B. The most commonly used grouping technique used by the teacher respondents is a single large group of students with mixed skill abilities. The second most commonly used grouping technique is a single large group of students with similar skill abilities; and, the third most commonly used grouping technique is small groups of students with similar skill abilities.

C. Teachers are able to provide some kind of remedial instruction and/or enrichment activities to students in their classrooms. Teachers are more apt to include remedial activities rather than enrichment activities.

D. Estimating is not encouraged by most teachers. Intermediate grade level teachers are more likely to encourage estimating than are primary grade level teachers, and teachers perceiving their students to have high abilities are more likely to use estimating.

E. Giving students credit for using the correct procedures for solving a calculation problem, even though the student arrives at the wrong answer, is done by only about half of the teachers.

F. Daily work and textbook tests are the most common means used to measure student progress, to grade students, and to diagnose their weaknesses. The least used means for measuring student progress is by building and district-developed tests.

G. Teachers focus most of their time in class on math concepts and computation skills (at least 2-3 times per week). The primary grade level teachers spend more time than intermediate grade level teachers on drilling basic facts and practicing computation skills. Intermediate grade level teachers spend more time on math concepts than do primary grade level teachers.

H. Problem solving skills are presented in class only about once a week and measurement skills are practiced about once every two weeks.

I. Unit tests are administered about once every two weeks.

J. Calculators and computers are used less than once every two weeks.

K. Computers are scarce in the buildings. Seventy-four percent of the teachers had either no access at all to a computer or have access only at the building (and not the classroom) level.

4. TEACHERS' PERCEPTION OF THEIR STUDENTS ABILITIES AND ACHIEVEMENT

A. Overall, teachers consider their students to be about average in ability (the mean score was 312.65 out of a possible range of scores from 100 to 500).

B. Teachers perceive the level of achievement of their students to be less than the perceived level of their students' abilities (the mean score for achievement was 308.38).

5. TEACHERS' PERCEPTION OF MATH

A. Teachers consider math to be important.

B. Teachers feel quite comfortable teaching math and adjusting the curriculum to meet the needs of more able students.

C. Few teachers claim they teach math the same way they were taught math.

6. TEACHER TRAINING

A. Many teachers have not had much formal training for teaching math. The average number of math classes taken at the undergraduate level is 2.37; and, of these classes only 1.14 relate to methods of teaching math.

B. The areas of teaching math for which at least 25 percent of the teachers mentioned they would like to receive additional training include: remedial techniques; enrichment programs; teaching problem solving; using computers; diagnosing student errors; using logic and reasoning in math; and, teaching math concepts

C. Most teachers do not have access to inservice or staff development in math. Few teachers have received a district-wide workshop in math within the last three years.

7. THE RELATIONSHIP BETWEEN GROUPING TECHNIQUES AND INSTRUCTION

A. Teachers teaching small groups of students with similar skills are more likely to use standardized tests and homework assignments to measure student progress in math compared to teachers teaching to a single large group of either mixed or similar skills.

B. Teachers teaching small groups of students with similar skills are more likely to use enrichment activities, assign homework for concept discovery, and use computers for math games than teachers teaching to a single large group of students with either mixed or similar skills.

C. Teachers teaching a single large group of students of similar skills are more likely to use team teaching and use skill sheets than teachers teaching to a large group of students of mixed skills or teachers teaching to small groups of similar skills.

D. Teachers teaching students with similar skills (either in a large or small group setting) feel more comfortable adjusting the curriculum to meet the needs of more able students in the class than did teachers teaching to a class of mixed skill abilities.

E. Teachers of a single large group (either of mixed or similar skills) spend more time drilling the basic facts than did teachers teaching to small groups of students of similar skills.

8. RELATIONSHIP BETWEEN TEACHERS' PERCEPTION OF THEIR STUDENTS' ABILITIES AND INSTRUCTION

A. Teachers who use remedial and/or enrichment activities in the classroom perceive their students to have a higher level of ability in math than teachers who do not use these types of activities.

B. Teachers who frequently use estimating perceive their students to have a higher level of ability in math than teachers who seldom or never use estimating .

C. Teachers who use textbook tests for measuring student progress perceive their students to have a higher level of ability in math than teachers who do not use textbook tests.

9. RELATIONSHIP BETWEEN ACHIEVEMENT AND SOCIAL ECONOMIC STATUS

A. The correlation coefficient describing the relationship between student achievement (based on the 1984 state-wide test results in math) and SES is positive, but low.

10. RELATIONSHIP BETWEEN DISTRICT SIZE, INSTRUCTION, AND ACHIEVEMENT

A. Teachers in smaller size districts are more likely to have SLOs developed by teachers and are more likely to be involved in the development process than teachers in larger size districts.

B. The instructional materials in smaller districts are more likely to be selected by teachers in the district and teachers are more likely to be involved in the selection process. Instructional materials in larger districts are more likely to be selected by district administrators.

C. Teachers in small size districts are more likely to use standardized tests and textbook tests to measure student progress than teachers in larger size districts.

D. Teachers in districts with enrollment between 7,000 and 14,000 are more likely to use homework to measure student progress than teachers in other size districts.

E. A great proportion of high achieving schools are in the Size A category with enrollments between 01 and 2,000 and in Size C category with enrollments between 7,000 and 14,000. A greater proportion of low achieving schools fell in the Size B category with enrollments between 2,001 and 7,000 and in the Size D category with enrollments over 14,000.

11. RELATIONSHIP BETWEEN ACHIEVEMENT AND INSTRUCTION

A. Teachers in the high achieving schools are more likely to teach math to a large group of students of mixed skill abilities than teachers in the low achieving schools. Teachers in the low achieving schools are more likely to teach math to a single large group of similar skill abilities.

B. Teachers in the high achieving schools are more likely to use standardized tests and less likely to use homework to measure student progress than teachers in low achieving schools.

C. More time is spent teaching math in the high achieving schools.

D. Teachers have more years of teaching experience in high achieving schools.

E. Teachers in the high achieving schools perceive their students' abilities in math to be higher than do teachers who teach in the low achieving schools.

Implications for Future Research

The findings reported for this research project have stimulated thoughts for several future research topics that would provide more in-depth information relative to math instruction in elementary schools. Ten potential research topics are described below:

1. Student Learning Objectives (SLOs) are mandatory for all districts in the State of Washington. However, no studies have been conducted to determine how SLOs are actually used for instructional purposes. The findings of this study suggest that teachers use their SLOs only "moderately" to guide instruction. If teachers are not using the SLOs to a great extent to guide instruction, then the question arises as to what they do use to guide instruction.

   This study asked teacher to include an example of a math SLO they used to guide their instruction. Only 71 percent actually included a sample of an SLO. The reason why so few included a sample SLO is not known, but brings to mind another question that might be answered: To what extent are teachers recognizant of the SLOs identified for their grade level, as well as across grade levels?

   Finally, it would be interesting to determine the effect of the SLOs on student achievement and on district accountability practices. Are districts actually holding themselves accountable to the public through the implementation and assessment of their SLOs? How are districts assessing their SLOs?

2. This study determined that time spent teaching math is positively related to math achievement. However, this study was not designed to identify what was happening relative to time that seemed to increase achievement. What are teachers who spend more time teaching math doing in the extra time? Are they spending more time on drill and practice? on story problems? on measurement and geometry skills?

3. The findings from this study suggest that there was a relationship between grouping techniques used by a teacher and achievement. The grouping skill that most closely related to achievement was a single large group of students with mixed abilities in math. This finding needs to be validated. What is occuring in the large mixed group that is different from other grouping techniques? What techniques in the large group with students of mixed abilities are being employed by successful teachers? To what extent do teachers teaching a single large group of students subgroup within their class or use peer-tutoring?

4. Morris (1981) and Hamilton (1980) claimed that estimating allows students to relate math to real life. No studies could be found that have focused on the effect of estimating on achievement in math, or of the relationship between estimating and students' abilities to solve story problems, perform calculations, or use math reasoning. Also, what is the relationship between teachers' level of comfortableness in using estimating in the classroom and the extent to which estimating is used? And, finally, what kinds of estimating activities are being used by teachers?

5. Remedial and enrichment activities were used by most teachers included in the study. However, this study did not describe the kinds and amount of time spent on remedial or enrichment activities and their effectiveness. How do

teachers incorporate remedial and enrichment activities into their classroom management plan? What kinds of students are exposed to remedial and/or enrichment activities?

6. Problem solving was implemented by teachers approximately once every week. It would be interesting to determine the effect of time spent on story problems and students' achievement in math. How are story problems being taught? And, what determines how and when story problems are taught?

7. Measurement and geometry were taught less than once every two weeks. Questions of interest are: 1) Why are these skills not taught more often? 2) What are the effects of teaching measurement and geometry skills on student achievement in math, on student spatial abilities, and on student ability to use reasoning and logic in math? 3) What are the effects of not spending a great deal of time on measurement and geometry skills at the elementary level on skills to be mastered in junior high and high school?

8. Few teachers indicated they had access to computers in their classrooms. Computers were used most often for the purpose of math games. The effects of computer math games on student achievement in math should be determined. Also, how are classes organized to incorporate the computer into the instructional time? What students are most likely to be allowed to work with the computer? What is the effect of teaching computer programming on students' spatial abilities, on their abilities to reason logically?

9. The college teacher preservice training programs in the state should be reviewed to determine their requirements in math for elementary teacher degrees. To what extent do existing programs focus on the areas for which at least 25 percent of the teachers in this study indicated they would like to receive additional training? Another related question of interest is: Do teachers who have a major or a minor degree in math teach math to elementary students differently than teachers who do not have a major or minor in math?

10. A current debate in the State of Washington is whether or not rural districts should consolidate. The results of this study show that "second class" districts with enrollment from 01 to 2000 were different from larger size districts (and the differences were not necessarily negative). However, this study did not focus on the rural districts per se. More in-depth analysis regarding differences in math curriculum content and instruction in rural districts compared to larger sized districts is needed. This analysis also should focus on other potentially related factors, such as teacher, student, and parent attitudes towards math.

APPENDIX A

TEACHER AND PRINCIPAL SURVEY INSTRUMENTS

GONZAGA UNIVERSITY
SPOKANE, WASHINGTON 99258 / PHONE: (509) 328-4220

February 1, 1984

Dear Educator:

The Research and Development Center at Gonzaga University is conducting a study to describe how math is taught in elementary schools in Washington. The results of this survey will be used to identify potential preservice and inservice needs of elementary math teachers in the State.

We would appreciate you taking a few moments to complete the attached survey designed for this study. The survey is comprised of three parts: Part I relates to math instruction; Part II focuses on teacher perceptions about math education; and Part III relates to demographics including teacher preparation and professional resources used for teaching math.

After you have completed the survey, please place it in the plain envelope provided, seal the envelope and return it to your building principal. The principal will return to the Research Center all completed surveys en masse.

The Research Center appreciates your willingness to participate in this study. If you have any questions or concerns about the research project, please feel free to contact us at any time.

Cordially yours,

Sandra M Wilson

Sandra Meacham Wilson (Ph.D)
Associate Director and
Research Project Coordinator

TEACHER SURVEY

PART I

1. The Student Learning Objectives for elementary mathematics in your district were identified PRIMARILY by: (check only one)

   ☐ district administration

   ☐ district teacher curriculum committee(s)

   ☐ building grade level team recommendations

   ☐ individual teacher recommendations to building or district administrator

   ☐ other (Please specify)_____

2. Were you actively involved in the identification of the SLOs for elementary mathematics?

   ☐ yes

   ☐ no

3. To what extent do the district SLOs guide the instruction you provide your students? (circle your response)

Extensively				Not At All
5	4	3	2	1

4. Please provide an example of <u>one</u> SLO for your grade level that involves <u>either</u> addition, subtraction, multiplication, or division.

_____

_____

_____

_____

5. To what extent are the math SLOs for your district sequenced from one grade level to the next?

Very Sequenced				Not At All Sequenced
5	4	3	2	1

6. Are there minimum competencies in mathematics specified for each elementary grade level?

   ☐ yes
   ☐ no

7. Do you use instructional materials in math which were selected by your district?

   ☐ yes
   ☐ no (If not, please go on to question 11)

8. The decision regarding the selection of the math instructional materials your district currently uses was PRIMARILY made by: (check only one)

   ☐ district administration

   ☐ a district teacher curriculum committee

   ☐ building grade level team recommendations

   ☐ individual teacher recommendations to building or district administration

   ☐ other (please specify)_____

9. Were you actively involved in the selection of the district math instructional materials?

   ☐ yes
   ☐ no

10. How many years has the district been using these math instructional materials? _____

11. Which of the following types of instructional materials do you use as a PRIMARY source and which do you use as SUPPLEMENTAL material? (check the appropriate column)

	PRIMARY	SUPPLEMENTAL
a. basal text	☐	☐
b. workbook	☐	☐
c. skill sheets	☐	☐
d. individualized programmed text	☐	☐
e. teacher-made materials	☐	☐
f. films	☐	☐
g. videotapes	☐	☐
h. computer software	☐	☐
i. other (please specify)	☐	☐

_____

12. Rate the quality of the instructional materials for each of the following criterion (Please do not rate on a criterion if you are not sure) Circle your response.

	RATING				
CRITERION	Excellent	Good	Average	Below Average	Poor
Match to SLOs	5	4	3	2	1
Application to Real Life	5	4	3	2	1
Math Concepts	5	4	3	2	1
Problem Solving	5	4	3	2	1
Computation	5	4	3	2	1

13. To which grade(s) do you teach math? _____

14. How much time per day do you spend teaching mathematics?_____

15. What time of the day do you usually teach math?
    - ☐morning
    - ☐afternoon

16. Approximately how much time do you spend preparing for a math lesson? _____

17. What is the primary grouping pattern you use for instructing math? (check only one)
    - ☐small group -similar skill levels
    - ☐small group -mixed skill levels
    - ☐large group -similar skill levels
    - ☐large group mixed skill level
    - ☐individualized

18. Do you use a team teaching approach?
    - ☐yes
    - ☐no

19. How many students are in your class at the time you teach math? _____

20. Are you able to provide remedial or supplemental instruction in math to less able students in your classroom?

- ☐ yes
- ☐ no

21. Are you able to provide enrichment activities in math to students who are more able than most students in your class?

- ☐ yes
- ☐ no

22. To what extent do you encourage students to use estimation or guessing when working math problems?

- ☐ almost always
- ☐ frequently
- ☐ seldom
- ☐ never

23. Do you usually give students credit for using the correct procedures for solving a math problem even though they come up with the wrong answer?

- ☐ yes
- ☐ no

24. How do you measure your students' progress in math? (Check all that apply)

- ☐ Standardized norm referenced test(s)
- ☐ District developed test(s)
- ☐ Building developed test(s)
- ☐ Text book test(s)
- ☐ Homework assignments
- ☐ Daily work
- ☐ Other (Please specify)_____

25. Of the measuring techniques you checked in question 24, on which one do you place the greatest amount of emphasis when grading students? _____

On which one do you place the greatest amount of emphasis when diagnosing students' strengths and weaknesses?

_____

26. Do you have access to a computer(s) in your classroom or building?

- ☐ yes, in the classroom
- ☐ yes, in the building
- ☐ no

27. Please rate the frequency with which the following occur while you are teaching math. Place a check in the column that represents your answer.

	4-5 times/ week	2-3 times/ week	once/ week	once every 2 weeks	less than once evry 2 weeks	do not use
a. assign homework for reinforcement						
b. assign homework for concept discovery						
c. review homework assignments						
d. teach math concepts						
e. teach problem solving skills						
f. teach computational skills						
g. teach calculation to solve problems						
h. give unit or skill test						
i. use exploratory or hands-on materials to develop a concept						
j. use peer-tutoring or teaching						
HAVE STUDENTS k. work math problems alone						
l. work problems on the board						
m. plan a math instructional unit						
n. use math games, puzzles, etc.						
o. drill basic facts						
p. practice computational skills						
q. practice work or story problems						
r. practice measurement skills						
s. practice graphing skills						
t. use calculators						
u. use computers for math games						
v. use computers for programming						
w. use computers to learn math concepts						

26. What percent of the students in your math class fall into each of the following ABILITY levels relative to math?

_____% well above average ability
_____% above average ability
_____% average ability
_____% below average ability
_____% well below average ability
(total should equal 100%)

29. If your students were tested in MATH using a standardized nationally normed referenced achievement test, what percent of your students would fall into each of the following ACHIEVEMENT levels:

_____% well above average achievement
_____% above average achievement
_____% average achievement
_____% below average achievement
_____% well below average achievement
(total should equal 100%)

PART II

Rate the extent to which you agree with each of the following statements. Circle your response.

SA = Strongly Agree
A = Agree
D = Disagree
SD = Strongly Disagree

	STATEMENT	RATING			
30.	Mathematics has contributed greatly to society.	SA	A	D	SD
31.	Mathematics has contributed greatly to science and other fields of knowledge.	SA	A	D	SD
32.	Mathematics helps develop a person's ability to think logically.	SA	A	D	SD
33.	An understanding of mathematics is needed by artists and writers as well as scientists.	SA	A	D	SD
34.	I am comfortable teaching mathematics.	SA	A	D	SD
35.	I teach mathematics in much the same way that mathematics was taught to me in elementary school.	SA	A	D	SD
36.	Parents in this community value the study of mathematics.	SA	A	D	SD
37.	I am comfortable adjusting the mathematics curriculum to meet the needs of more able students.	SA	A	D	SD
38.	A person's career/vocational choices are influenced by their math achievement.	SA	A	D	SD
39.	The majority of my students seem to enjoy learning math.	SA	A	D	SD
40.	I feel comfortable teaching math concepts.	SA	A	D	SD
41.	I feel comfortable teaching problem solving in math.	SA	A	D	SD
42.	I am more comfortable teaching mathematics than I am teaching other subjects.	SA	A	D	SD

PART III

43. Gender: ☐ male ☐ female

44. How many years have you taught elementary math? _____

45. What was your major and minor for your Bachelor's degree?

_____Major _____Minor

46. Have you earned you Master's Degree?

☐ yes (Major _____)
☐ no

47. How many classes in mathematics did you take as an undergraduate? _____

48. Of those classes in mathematics you took as an undergraduate, how many were related to methods of teaching mathematics?

_____

49. How many classes in mathematics have you taken beyond your Baccalaureate degree? _____

50. Do you feel the college training you received for teaching math was adequate?

☐ yes ☐ no

51. If you answered "no" to question 50, in what areas would additional preparation have been most useful? (Check all that apply)

☐ math concepts
☐ problem solving skills
☐ geometry/measurement
☐ using computers
☐ mainstreaming
☐ teaching math methodologies
☐ remedial techniques
☐ computation skills
☐ logic and reasoning
☐ using calculators
☐ enrichment program
☐ diagnosiing students' math errors
☐ other_____

52. Have you attended any mathematics inservice sessions or workshops in the last five years? ☐ yes ☐ no

If yes, what was the title? _____

GONZAGA UNIVERSITY
SPOKANE, WASHINGTON 99258 / PHONE: (509) 328-4220

February 1, 1984

Dear Principal:

Your District Superintendent has been contacted by phone and has provided the Research and Development Center at Gonzaga University permission to use your school (that was randomly selected) in a study of math education. The purpose of the study is to describe how math is taught in elementary schools in Washington. We are looking at the following aspects of math education:

* Math curriculum and development
* Math instruction
* Teacher perceptions about math
* Teacher preparation

The results of this confidential survey will be used to identify potential preservice and inservice needs of elementary math teachers in the State.

The Principal Survey focuses on general math instruction and procedures used to test math achievement in your building. In addition, there are a few questions related to demographic characteristics of your school.

Please complete the Principal Survey, distribute and collect Teacher Surveys for all teachers of grades 1-6 in your building who teach math (with the exception of special education teachers), and return all surveys in the large self-addressed and stamped envelope provided.

For your information, this math study is supported by the School Information and Research Service (SIRS); furthermore, the ESD 101 Staff Development and Training Center acknowledges and supports this research project.

We are appreciative of your cooperation. If you have questions about this research project, please feel free to contact us at any time.

Cordially yours,

Sandra M Wilson

Sandra Meacham Wilson (Ph.D.)
Associate Director and
Research Project Coordinator
(Ext. 3517)

SMW:pp

Enclosures

PRINCIPAL SURVEY

1. What is the predominant mode of teaching mathematics in your building? (check only one)

   ☐ teachers specializing in math
   ☐ team teachers across grade levels
   ☐ team teachers within grade levels
   ☐ self-contained classroom teaching
   ☐ other _____

2. Do teachers in your building have access to a math specialist?

   ☐ Yes If yes, do they use the specialist? ☐ Yes ☐ No
   ☐ No

3. Do teachers in your building have continual access to inservice or staff development in mathematics?

   ☐ Yes
   ☐ No

4. Have teachers in your building had a building or district wide workshop in mathematics in the last three years?

   ☐ Yes Please indicate title(s)_____
   ☐ No

5. Relative to other subject areas, is math instruction in your building

   ☐ a strength
   ☐ about average
   ☐ a weakness

6. Please list the standardized test(s) you use to measure student achievment in mathematics and check whether each test is administered only in your building or district wide.

Test	Building Administered	District Administered
_____	_____	_____
_____	_____	_____
_____	_____	_____

7. Please rate the extent to which standardized test results are used <u>in your building</u> (and/or district) in each of the ways listed below. Circle your response.

	Extensively				Not at all
a. To identify topics for math inservice or workshop	5	4	3	2	1
b. To inform parents how well their child is achieving in math	5	4	3	2	1
c. To identify needed changes in math instruction	5	4	3	2	1

8. How well do your third grade math SLOs match the State Fourth Grade Achievement Test administered each fall?

- ☐ an excellent match
- ☐ a good match
- ☐ a moderate match
- ☐ a low level match
- ☐ don't know

9. What is the building median percentile score obtained for the State Fourth Grade Test in MATH for the Fall 1983 testing?

_____

10. How does the percentile score stated above compare to math scores usually obtained for other grade levels in your building?

- ☐ above
- ☐ about the same
- ☐ below

11. How many students are enrolled in each grade level in your building?

___ Kindergarten	___ Fourth Grade
___ First Grade	___ Fifth Grade
___ Second Grade	___ Sixth Grade

12. About what percentage of pupils served by your school fall into each of the categories below? (Total should equal 100%.)

_____Children of professionals and managers (physicians, lawyers, engineers, and executives).

_____Children of white collar workers other than those above (proprietors, salespersons, clerks).

_____Children of skilled workers (electricians, carpenters, factory workers).

_____Children of unskilled workers (laborers, custodians, dishwashers).

_____Unemployed, welfare, etc.

APPENDIX B

SPSS DATA PLANS:

Teacher Data Plan
Principal Data Plan

TEACHER DATA PLAN

COLUMN	DATA NOTES/VARIABLE DESCRIPTION	SPSS LABEL	
1	Card #1	F Card	
2-3-4	Use new (3 digit) number	School	
5	Size descriptions: A = 1 B = 2 C = 3 D = 4	Size	
6-7	Enter 2-digit teacher number	TeachID	xx
8-9	Fourth grade % score which is third number listed on every survey; type 00 if N.A. or N.G. is listed on survey	FOURTH	
10	Enter one of the following: 1 = district administrator 2 = district teacher 3 = bldg grade level team 4 = individual teacher 5 = other		SLO1
11	Enter 1 = yes 2 = no	INVOLVE	SLO2
12	Enter one of the following: 5 4 3 2 1	EXTENT	SLO3
13	Enter: 3 2 1 0	SLOEX	SLO4
14	Enter: 5 4 3 2 1	SLOSEQ	SLO5
15	Minimum competencies Enter 1 = yes 2 = no	MINCOM	
16	Enter 1 = yes 2 = no (If no, type 0's until Question 11 or Column 20)	SELECT	CUR1
17	Enter one of the following: 5 = district administrator 4 = district teach. curr. committee 3 = bldg grade level team 2 = individual 1 = other	DECISION	CUR2

COLUMN	DATA NOTES/VARIABLE DESCRIPTION	SPSS LABEL
18	Enter 1 = yes 2 = no	INVOLVE CUR3
19-20	List years, or 00 if none given	CURYRS
21-29	For each item, type: 1 = primary 2 = supplementary 3 = blank a. basal test b. workbook c. skill sheets d. individualized programmed text e. taecher-made materials f. films g. videotapes h. computer software i. other	CURTYPE1 to CURTYPE9
30-34	For each item enter: 5 4 3 2 1 a. match to SLOs b. application c. math concepts d. problem solving e. computation	QUALITY1 to QUALITY5
35	Enter grade listed: 1 2 3 4 5 6 or (where more than one grade level is taught) 7 = K-3 8 = 4-6 9 = all (more than three grade levels or all grade levels)	GRTEACH
36-37	Enter length of time per day	TIME
38	Enter 1 = a.m. 2 - p.m.	DTIME
39-40	Enter time spent preparing lesson	PTIME
41	Enter number of item checked: 1 = small group/similar skill 2 = small group/mixed skill 3 = large group/similar skill 4 = large group/mixed skill 5 = individualized	GROUPING
42	Enter 1 = yes 2 = no	TEAMTCH

COLUMN	DATA NOTES/VARIABLE DESCRIPTION	SPSS LABEL
43-44	List number of students	STUDENTS
45	1 = yes 2 = no	REMEDIAL
46	1 = yes 2 = no	ENRICH
47	Enter one number: 1 = almost always 2 = frequently 3 = seldom 4 = never	GUESS
48	1 = yes 2 = no	CREDIT
49-55	For each item, enter 1 = yes 2 = no 48. standardized nore referenced tests (1) 49. district-developed tests (2) 50. building-developed tests (3) 51. text book tests (4) 52. homework assignments (5) 53. daily work (6) 54. other (6)	PROGRES1 to PROGRES2
56	See list for survey question 24 (above) Enter only one of the seven (1-7)	EMPHGRAD
57	See list for survey question 24 (above) Enter only one of the seven (1-7)	EMPHDIAG
58	Enter: 1 = yes, in the classroom 2 = yes, in building 3 = no	COMPUTER
59-71	For each item a-M, 5 - 0: 5 = 4-5x/week 4 = 2-3x/week 3 = once week 2 = once every two weeks 1 = less than every two weeks 0 = does not use	FREQ1 TO FREQ13

COLUMN	DATA NOTES/VARIABLE DESCRIPTION	SPSS LABEL
1	New card B, type 2	S Card
2-3-4 5 6-7	School ID # School size Teacher ID #	
8-17	For each item, n-w, enter 5 - 0 (see coding above)	FREQ14 to FREQ23
18-27	Enter % given for each item (NOTE: If 100% for any one category, enter 99) a. ___% well above average b. above average c. average d. below average e. well below average	ABILITY1 to ABILITY5
28-37	Enter % given for each item (Note: If 100% for any category, enter 99) a. b. c. d. e.	ACHIEVE1 to ACHIEVE5
38-50	For columns 37-49, enter 4 3 2 1 for each statement: 4 = strongly agree 3 = agree 2 = disagree 1 = strongly disagree	Q30 to Q42
51	1 = male 2 = female	GENDER
52-53	Enter number of years listed	YEARS
54	Enter: 1 = math 2 = science 3 = neither math or science	MAJOR
55	See entries above	MINOR
56	Enter 1 = yes 2 = no	MASTERS

COLUMN	DATA NOTES/VARIABLE DESCRIPTION	SPSS LABEL
57-58	Enter number given	UNDERG
59	Enter number given	METHODUG
60-61	Enter number given	GRADUAGE
62	Enter 1 = yes 2 = no	ADEQUATE
63-75	For each item, enter 1 = yes 2 = no If let blank, enter 0's until column 75	TRAIN1 to TRAIN13
76	Enter 1 = yes 2 = no	ATTEND

COLUMN	VARIABLE DESCRIPTION	SPSS LABEL
15	Enter one: 1 = an excellent match 2 = a good match 3 = a moderate match 4 = a low level match 5 = don't know	MATCH
16-17	Enter percentile score. If blank, enter ØØ	MEDIAN
18	1 = above 2 = about the same 3 = below	COMPARE
	For each following grade level, enter three digits	ENROLL to ENROLL 7
19-21	K	
22-24	First	
25-27	Second	
28-30	Third	
31-33	Fourth	
34-36	Fifth	
37-39	Sixth	

Example:

28 K, enter Ø28

If blank, enter ØØØ

	Enter percentage for each category below. If 100%, enter 99.	POPULA1 to POPULA5
40-41	Children of professionals & managers	
42-43	Children of white collar workers	
44-45	Children of skilled workers	
46-47	Children of unskilled workers	
48-49	Children of unemployed, welfare	

PRINCIPAL DATA PLAN

COLUMN	VARIABLE DESCRIPTION	SPSS LABEL
1-3	Use second three digit # on Adm.'s survey	SCHOOL ID
4	Size description A = 1 B = 2 C = 3 D = 4	SIZE
5	Enter one of the following: 1 = teachers specializing 2 = team teaching across 3 = team teaching within 4 = self-contained 5 = other	MODE
6	1 = yes 2 = no	SPEC1
7	1 = yes 2 = no	SPEC2
8	1 = yes 2 = no	INSERV
9	1 = yes 2 = no	WKSHOP
10	Enter only one: 1 = a strength 2 = about average 3 = a weakness	RELATIVE
11	Enter only one: 1 = building level only 2 = district level only 3 = both building & district 4 = no tests lists	MEASURE
12	Enter only one: 5 4 3 2 1	TEST1
13	Enter only one: 5 4 3 2 1	TEST 2
14	Enter only one: 5 4 3 2 1	TEST 3

APPENDIX C

TABLES REORTING RESULTS FOR RESEARCH QUESTION 1.

How are math curriculums developed and structured?

Table 1. Procedures Used to Develop District Student Learning Objectives (SLOs)

Procedures	Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
District administration	11 (6)	14 (10)	12 (8)	10 (7)	12 (9)	15 (13)	90 (9)
District teacher	100 (60)	90 (62)	101 (69)	93 (67)	88 (68)	78 (69)	631 (65)
Building grade level	33 (20)	24 (17)	24 (16)	17 (12)	14 (11)	9 (8)	134 (14)
Individual teacher	4 (2)	8 (6)	2 (1)	6 (4)	5 (4)	5 (4)	41 (4)
Other	19 (11)	8 (6)	7 (5)	12 (9)	11 (9)	6 (5)	78 (8)

Table 2. Involvement of Teachers in Development of SLOs

Involvement	Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
YES	55 (32)	50 (35)	50 (34)	52 (37)	39 (29)	33 (29)	335 (34)
NO	115 (67)	93 (65)	99 (66)	88 (63)	95 (71)	82 (71)	654 (66)

Table 3. The Extent to Which Teachers Used the SLOs to Guide Instruction*

	Grade 1	2	3	4	5	6	Overall
Mean score	3.74	3.85	3.73	3.59	3.66	3.58	3.69
Standard deviation	1.11	.90	.93	1.07	1.01		1.03
Md score	3.89	3.92	3.81	3.69	3.84		3.80

*Based on a five point scale where 5 = extensively and 1 = not at all

Table 4. The Level of Specificity of District SLOs in Math

SLO Level of Specificity	Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
Very specific	97 (76)	90 (83)	83 (72)	68 (69)	58 (69)	44 (81)	502 (71)
Moderately specific	18 (14)	14 (13)	22 (19)	26 (26)	19 (23)	33 (38)	152 (21)
Not very specific	12 (9)	4 (4)	10 (9)	5 (5)	7 (9)	9 (10)	55 (8)

*Teachers were asked to include a sample of a math SLO. The researchers then rated the SLOs relative to its level of specificity.

Table 5. The Degree of Sequence of the SLOs Across Grade Levels*

	Grade 1	2	3	4	5	6	Overall
Mean score	4.09	4.11	4.17	4.18	4.25	4.18	4.15
Standard deviation	.93	.83	.77	.85	.78		.84
Md score	4.18	4.16	4.21	4.28	4.32	4.20	3.80

*Based on a five point scale where 5 = extensively and 1 = not at all

Table 6. Whether or Not There Are Minimum Competencies for Each Grade Level

	Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
YES	123 (74)	93 (67)	103 (72)	97 (70)	78 (59)	63 (56)	645 (67)
NO	42 (25)	31 (33)	39 (27)	42 (30)	54 (41)	50 (44)	314 (33)

Table 7. Whether the Instructional Materials Used Were Selected by the Districts

	Grade												Overall	
	1		2		3		4		5		6			
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
YES	157	(94)	123	(87)	145	(96)	132	(94)	132	(98)	111	(96)	928	(94)
NO	12	(7)	19	(13)	5	(3)	8	(6)	1	(7)	5	(4)	57	(6)

Table 8. Procedures Used to Select Instructional Materials

Procedures	Grade												Overall	
	1		2		3		4		5		6			
District administration	10	(6)	10	(7)	12	(8)	12	(8)	10	(7)	14	(12)	643	(64)
District teacher	106	(62)	88	(61)	96	(63)	97	(69)	96	(71)	75	(65)	120	(12)
Building grade	26	(15)	23	(16)	22	(14)	15	(11)	10	(7)	9	(8)	120	(12)
Individual	10	(6)	6	(4)	3	(2)	5	(3)	7	(5)	7	(6)	55	(5)
Other	6	(3)	6	(4)	12	(8)	5	(3)	8	(6)	5	(4)	50	(5)

Table 9. Whether Teachers Were Involved in the Selection of the Instructional Materials

	Grade												Overall	
	1		2		3		4		5		6			
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
YES	52	(32)	39	(29)	45	(30)	37	(27)	38	(29)	29	(26)	287	(30)
NO	110	(68)	96	(71)	104	(70)	100	(73)	93	(71)	82	(74)	669	(70)

Table 10. Types of Curriculum Materials Used as a Primary (P) and/or Supplemental (S) Source for Instruction

		Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
Basal test	P	75 (44)	84 (59)	143 (94)	134 (95)	128 (95)	114 (98)	793 (79)
	S	5 (3)	2 (1)	6 (4)	5 (3)	2 (1)	1 (.9)	28 (3)
Workbook	P	130 (76)	100 (69)	25 (16)	21 (15)	13 (10)	24 (21)	357 (36)
	S	12 (7)	11 (8)	51 (34)	42 (30)	48 (36)	38 (33)	242 (24)
Skill sheets	P	48 (28)	45 (31)	48 (32)	40 (28)	32 (24)	18 (15)	264 (26)
	S	106 (62)	88 (61)	96 (63)	90 (64)	93 (69)	81 (70)	644 (64)
Individualized program text	P	7 (4)	7 (5)	6 (4)	3 (2)	4 (3)	3 (3)	37 (4)
	S	27 (16)	17 (12)	41 (27)	35 (25)	31 (23)	19 (16)	201 (20)
Teacher made materials	P	35 (20)	22 (15)	32 (21)	23 (16)	17 (13)	16 (14)	176 (18)
	S	119 (70)	107 (74)	102 (67)	96 (68)	92 (68)	88 (76)	688 (69)
Films	P	5 (3)	4 (3)	1 (.7)	0	1 (.7)	1 (.9)	14 (1)
	S	60 (35)	45 (31)	55 (36)	50 (35)	52 (38)	47 (40)	344 (34)
Video tapes	P	0 ( )	1 (.7)	0	1 (.7)	0	0	3 (.3)
	S	12 (7)	10 (7)	23 (15)	15 (11)	11 (8)	11 (9)	96 (10)
Computer software	P	2 (1)	3 (2)	3 (2)	5 (3)	0	1 (.9)	20 (2)
	S	50 (29)	42 (29)	56 (37)	52 (37)	52 (38)	38 (31)	354 (35)
Other	P	13 (8)	5 (3)	2 (1)	5 (3)	1 (.7)	1 (.9)	37 (4)
	S	27 (16)	16 (11)	18 (12)	7 (5)	7 (5)	8 (7)	99 (10)

Table 11. Teachers' Perceived Quality of the Instructional Materials They Use*

Quality	Grade 1	2	3	4	5	6	Overall
Match to SLOs	3.95	3.82	3.79	3.96	4.04	3.94	3.91
Application to real life	3.62	3.49	3.48	3.52	3.43	3.31	3.47
Math concepts	3.92	3.79	3.63	3.77	3.81	3.69	3.77
Problem solving	3.18	3.16	3.17	3.21	3.19	3.15	3.18
Computation	4.02	4.04	3.81	3.89	3.98	3.89	3.94

*Based on a five point scale where 5 = excellent and 1 = poor

APPENDIX D

TABLES REPORTING RESULTS FOR RESEARCH QUESTION 2:

How are students being instructed in math?

Table 1. Time Teachers Spend Teaching and Preparing for Math and the Time of Day Math is Taught

	Grade						
	1	2	3	4	5	6	Overall
Mean time for instruction/day	40.47	42.83	46.68	50.93	50.39	51.31	47.69
Mean time spent preparing for math/day	15.80	16.54	15.75	15.67	15.32	15.27	16.09
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Time of day math is taught AM	39 (24)	49 (36)	86 (59)	94 (68)	102 (81)	88 (77)	539 (57)
Time of day math is taught PM	126 (76)	86 (64)	58 (40)	44 (32)	24 (18)	26 (23)	406 (43)

Table 2. Grouping Techniques Used

	Grade						
Procedures	1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
Small groups, similar skill	17 (10)	6 (4)	21 (14)	30 (21)	23 (17)	16 (14)	160 (16)
Small groups, mixed skill	4 (2)	6 (4)	4 (3)	3 (2)	4 (3)	5 (4)	41 (4)
Large group, similar skill	49 (29)	61 (43)	50 (33)	55 (39)	54 (40)	47 (40)	346 (35)
Large group, mixed skill	84 (50)	68 (48)	73 (48)	47 (33)	51 (38)	44 (38)	298 (40)
Individualized	13 (8)	1 (.7)	3 (2)	6 (4)	2 (1)	4 (3)	42 (4)

Table 3. Whether Teachers Are Able to Provide Remedial and Enrichment Activities for Students

		Grade						
		1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
Remedial	YES	55 (32)	50 (35)	50 (34)	52 (37)	39 (29)	33 (29)	335 (34)
	NO							
Enrichment	YES	115 (67)	93 (65)	99 (66)	88 (63)	95 (71)	82 (71)	654 (66)
	NO							

Table 4. Whether Teachers Team Teach Math with Other Teachers

	Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
YES	9 (5)	17 (12)	13 (9)	15 (11)	29 (22)	28 (24)	130 (13)
NO	160 (95)	125 (88)	138 (91)	125 (89)	102 (77)	88 (76)	856 (87)

Table 5. The Frequency that Teachers Encourage Students to Use Estimation

Response	Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
Almost always	4 (2)	2 (1)	6 (4)	5 (4)	7 (5)	11 (10)	42 (4)
Frequently	47 (27)	28 (19)	48 (32)	62 (44)	68 (51)	54 (48)	370 (38)
Seldom	86 (50)	87 (61)	85 (57)	71 (51)	53 (40)	47 (42)	488 (50)
Never	29 (17)	24 (17)	11 (7)	2 (1)	5 (4)	0	80 (8)

Table 6. Whether Teachers Give Students Credit for Using the Correct Procedures for Solving a Math Problem, Even Though They May Come Up with the Wrong Answer

	Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
YES	63 (45)	89 (65)	85 (58)	82 (59)	68 (51)	68 (62)	534 (57)
NO	76 (55)	47 (35)	61 (42)	56 (41)	66 (49)	42 (38)	402 (43)

Table 7. Procedures Used by Teachers to Measure Student Progress in Math

	Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
Standardized norm referenced tests	34 (20)	41 (28)	48 (32)	46 (33)	33 (24)	43 (37)	303 (30)
District level tests	37 (22)	49 (34)	40 (26)	35 (25)	34 (25)	23 (20)	242 (24)
Building level tests	9 (5)	12 (8)	11 (7)	12 (9)	15 (11)	10 (9)	81 (8)
Text book tests	135 (79)	120 (83)	132 (87)	128 (91)	117 (87)	99 (85)	851 (85)
Homework assignments	30 (17)	31 (22)	81 (53)	80 (57)	76 (56)	82 (71)	450 (45)
Daily work	164 (96)	138 (96)	148 (97)	129 91	114 (84)	104 (90)	923 (92)
Other	53 (31)	28 (19)	45 (30)	26 (18)	47 (35)	40 (34)	276 (28)

*Most emphasis placed on this method for grading students
**Most emphasis placed on this method for diagnosing student's progress

Table 8. Teacher Access to a Computer

	Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
Yes, in classroom	97 (76)	90 (83)	83 (72)	68 (69)	58 (69)	44 (81)	502 (71)
Yes, in building only	18 (14)	14 (13)	22 (19)	26 (26)	19 (23)	33 (38)	152 (21)
No access	12 (9)	4 (4)	10 (9)	5 (5)	7 (9)	9 (10)	55 (8)

BEST COPY AVAILABLE

Table 3. Frequency with Which Teachers Use Various Teaching Activities in Math

HAVE TEACHERS...	Grade 1	2	3	4	5	6	Overall
a. assign homework for reinforcement	1.03	1.25	2.52	3.01	3.47	3.84	2.44
b. assign homework for concept discovery	.42	.42	.80	1.02	1.21	1.77	.93
c. review homework assignments	.94	1.06	2.33	3.15	3.68	3.86	2.46
d. teach math concepts	3.88	3.87	3.92	4.08	3.95	4.04	3.95
e. teach problem solving skills	2.97	3.11	3.19	3.22	3.12	3.23	3.15
f. teach computational skills	4.03	4.04	4.19	4.26	4.13	4.29	4.14
g. teach calculation to solve problems	2.66	2.97	2.97	3.47	3.35	3.38	3.10
h. give unit or skill test	1.82	2.04	1.92	2.09	2.18	2.06	2.01
i. use exploratory or hands-on materials to develop a concept	3.28	2.37	2.07	1.68	1.52	1.32	2.12
j. use peer-tutoring or teaching	2.15	2.19	2.23	2.39	2.59	2.64	2.37
HAVE STUDENTS...							
k. work math problems alone	4.74	4.61	4.67	4.65	4.58	4.76	4.65
l. work problems on the board	3.30	3.53	3.54	3.74	3.66	3.43	3.53
m. plan a math instructional unit	1.69	1.83	1.63	1.92	1.50	1.26	1.66
n. use math games, puzzles, etc.	3.38	3.04	2.65	2.43	2.05	1.95	2.62
o. drill basic facts	4.03	4.24	4.35	3.77	3.29	2.69	3.77
p. practice computational skills	4.42	4.34	4.31	4.27	4.15	4.12	4.27
q. practice work or story problems	2.53	2.99	3.25	3.10	3.03	3.04	3.01
r. practice measurement skills	1.37	1.61	1.43	1.54	1.62	1.59	1.54
s. practice graphing skills	1.28	1.35	1.27	1.32	1.41	1.39	1.38
t. use calculators	.26	.20	.25	.36	.57	.76	.41
u. use computers for math games	.69	.79	.92	.73	.90	.86	.90
v. use computers for programming	.09	.17	.31	.41	.48	.56	.39
w. use computers to learn math concepts	.33	.41	.61	.54	.56	.70	.59

FREQ01	GRTEACH Primary (1)	Intermediate (2)	ROW TOTAL	
Less than once/ 2 weeks (1)	120 / 76.4 / 36.6 / 17.0	37 / 23.6 / 9.8 / 5.2	157 / 22.2	Assign homework for reinforcement
Once every 2 weeks (2)	39 / 69.6 / 11.9 / 5.5	17 / 30.4 / 4.5 / 2.4	56 / 7.9	
once/week (3)	70 / 52.6 / 21.3 / 9.9	63 / 47.4 / 16.6 / 8.9	133 / 18.8	
2-3 times/ week (4)	70 / 34.7 / 21.3 / 9.9	132 / 65.3 / 34.8 / 18.7	202 / 28.6	
4-5 times/ week (5)	29 / 18.2 / 8.8 / 4.1	130 / 81.8 / 34.3 / 18.4	159 / 22.5	
COLUMN TOTAL	328 / 46.4	379 / 53.6	707 / 100.0	

RAW CHI SQUARE = 133.09082 WITH 4 DEGREES OF FREEDOM. SIGNIFICANCE = .000

FREQ02	GRTEACH Primary (1)	Intermediate (2)	ROW TOTAL	
Dess than once/ 2 weeks (1)	85 / 58.6 / 54.5 / 23.9	60 / 41.4 / 30.2 / 16.9	145 / 40.8	Assign homework for concept discovery
once every 2 weeks (2)	27 / 49.1 / 17.3 / 7.6	28 / 50.9 / 14.1 / 7.9	55 / 15.5	
once/week (3)	26 / 33.3 / 16.7 / 7.3	52 / 66.7 / 26.1 / 14.6	78 / 22.0	
2-3 times/ week (4)	14 / 26.9 / 9.0 / 3.9	38 / 73.1 / 19.1 / 10.7	52 / 14.6	
4-5 times/ week (5)	4 / 16.0 / 2.6 / 1.1	21 / 84.0 / 10.6 / 5.9	25 / 7.0	
COLUMN TOTAL	156 / 43.9	199 / 56.1	355 / 100.0	

RAW CHI SQUARE = 30.87668 WITH 4 DEGREES OF FREEDOM. SIGNIFICANCE = .000

BEST COPY AVAILABLE

BEST COPY AVAILABLE

FREQ03	GRTEACH Primary (1)	GRTEACH Intermediate (2)	ROW TOTAL	
1 Less than once/2 wks	90	23	113	Review homework assignments
	79.6	20.4	17.8	
	33.5	6.3		
	14.2	3.6		
2 once every 2 wks	31	17	48	
	64.6	35.4	7.5	
	11.5	4.6		
	4.9	2.7		
3 once/wk	63	59	122	
	51.6	48.4	19.2	
	23.4	16.1		
	9.9	9.3		
4 2-3 times/wk	54	125	179	
	30.2	69.8	28.1	
	20.1	34.1		
	8.5	19.7		
5 4-5 times/wk	31	143	174	
	17.8	82.2	27.4	
	11.5	39.0		
	4.9	22.5		
COLUMN TOTAL	269	367	636	
	42.3	57.7	100.0	

RAW CHI SQUARE = 132.23312 WITH 4 DEGREES OF FREEDOM. SIGNIFICANCE = .0000

FREQ04	GRTEACH Primary (1)	GRTEACH Inter. (2)	ROW TOTAL	
1 less than once/2 wks	8	5	13	teach math concepts
	61.5	38.5	1.4	
	1.6	1.2		
	.9	.5		
2 once every 2 wks	30	29	59	
	50.8	49.2	6.4	
	5.9	7.0		
	3.2	3.1		
3 2-3 times once/wk	111	54	165	
	67.3	32.7	17.8	
	21.7	13.0		
	12.0	5.8		
4 2-3 times/wk	187	160	347	
	53.9	46.1	37.5	
	36.6	38.6		
	20.2	17.3		
5 4-5 times/wk	175	167	342	
	51.2	48.8	36.9	
	34.2	40.2		
	18.9	18.0		
COLUMN TOTAL	511	415	926	
	55.2	44.8	100.0	

RAW CHI SQUARE = 12.87405 WITH 4 DEGREES OF FREEDOM. SIGNIFICANCE = .0117

BEST COPY AVAILABLE

GRTEACH

FREQ07	Primary (1)	Interm. (2)	ROW TOTAL
1 less than once/2 wks	52	32	84
	61.9	38.1	11.1
	13.2	8.9	
	6.9	4.2	
2 once every 2 wks	49	36	85
	57.6	42.4	11.2
	12.4	10.0	
	6.5	4.8	
3 once/wk	105	80	185
	56.8	43.2	24.5
	26.6	22.2	
	13.9	10.6	
4 2-3 times/wk	103	125	228
	45.2	54.8	30.2
	26.1	34.6	
	13.6	16.5	
5 4-5 times/wk	86	88	174
	49.4	50.6	23.0
	21.8	24.4	
	11.4	11.6	
COLUMN TOTAL	395	361	756
	52.2	47.8	100.0

Teach calculation to solve problems

RAW CHI SQUARE = 10.76699 WITH 4 DEGREES OF FREEDOM. SIGNIFICANCE = .0293

GRTEACH

FREQ09	Primary (1)	Interm. (2)	ROW TOTAL
1 less than once/2 wks	134	193	327
	41.0	59.0	39.2
	27.6	55.3	
	16.0	23.1	
2 once every 2 wks	78	56	134
	58.2	41.8	16.0
	16.0	16.0	
	9.3	6.7	
3 once/wk	112	61	173
	64.7	35.3	20.7
	23.0	17.5	
	13.4	7.3	
4 2-3 times/wk	101	30	131
	77.1	22.9	15.7
	20.8	8.6	
	12.1	3.6	
5 4-5 times/wk	61	9	70
	87.1	12.9	8.4
	12.6	2.6	
	7.3	1.1	
COLUMN TOTAL	486	349	835
	58.2	41.8	100.0

Use exploratory or hands-on materials to develop a concept

RAW CHI SQUARE = 86.24522 WITH 4 DEGREES OF FREEDOM. SIGNIFICANCE = .0001

FREQ14		GRTEACH Primary 1	Intermedia 2	ROW TOTAL
less than once/2 wks	1	78 37.1 15.3 8.6	132 62.9 33.2 14.6	210 23.2
once every 2 wks	2	74 44.8 14.5 8.2	91 55.2 22.9 10.0	165 18.2
once/wk	3	172 61.6 33.8 19.0	107 38.4 26.9 11.8	279 30.8
2-3 times/ wk	4	103 67.3 20.2 11.4	50 32.7 12.6 5.5	153 16.9
4-5 times/ wk	5	82 82.0 16.1 9.0	18 18.0 4.5 2.0	100 11.0
COLUMN TOTAL		509 56.1	398 43.9	907 100.0

Use math games,puzzles, etc.

RAW CHI SQUARE = 77.67915 WITH 4 DEGREES OF FREEDOM. SIGNIFICANCE = .00

FREQ15		GRTEACH Primary 1	Interm 2	ROW TOTAL
less than once/ 2 wks	1	8 12.7 1.6 .9	55 87.3 13.4 6.0	63 6.8
once every 2 wks	2	15 25.0 2.9 1.6	45 75.0 11.0 4.9	60 6.5
once/wk	3	88 46.1 17.1 9.5	103 53.9 25.2 11.2	191 20.7
2-3 times/ wk	4	154 58.8 30.0 16.7	108 41.2 26.4 11.7	262 28.4
4-5 times/wk	5	249 71.8 48.4 27.0	98 28.2 24.0 10.6	347 37.6
COLUMN TOTAL		514 55.7	409 44.3	923 100.0

Drill basic facts

RAW CHI SQUARE = 114.56461 WITH 4 DEGREES OF FREEDOM. SIGNIFICANCE =

BEST COPY AVAILABLE

BEST COPY AVAILABLE

FREQ16	COUNT / ROW PCT / COL PCT / TOT PCT	GRTEACH Primary (1)	GRTEACH Interm (2)	ROW TOTAL
1 less than once/ 2wks		7 / 50.0 / 1.4 / .8	7 / 50.0 / 1.7 / .8	14 / 1.5
2 once every 2 wks		6 / 23.1 / 1.2 / .6	20 / 76.9 / 4.7 / 2.2	26 / 2.8
3 once/wk		44 / 45.4 / 8.7 / 4.8	53 / 54.6 / 12.5 / 5.7	97 / 10.5
4 2-3 times/wk		165 / 54.1 / 32.8 / 17.8	140 / 45.9 / 33.1 / 15.1	305 / 32.9
5 4-5 times/wk		281 / 58.1 / 55.9 / 30.3	203 / 41.9 / 48.0 / 21.9	484 / 52.3
COLUMN TOTAL		503 / 54.3	423 / 45.7	926 / 100.0

Practice computational skills

RAW CHI SQUARE = 16.20242 WITH 4 DEGREES OF FREEDOM. SIGNIFICANCE = .002

GUESS	COUNT / ROW PCT / COL PCT / TOT PCT	GRTEACH Primary (1)	GRTEACH Interm (2)	ROW TOTAL
1 almost always		14 / 34.1 / 2.7 / 1.5	27 / 65.9 / 6.3 / 2.8	41 / 4.3
2 frequently		152 / 42.3 / 28.9 / 15.9	207 / 57.7 / 48.3 / 21.7	359 / 37.6
3 seldom		292 / 61.0 / 55.5 / 30.6	187 / 39.0 / 43.6 / 19.6	479 / 50.2
4 never		68 / 89.5 / 12.9 / 7.1	8 / 10.5 / 1.9 / .8	76 / 8.0
COLUMN TOTAL		526 / 55.1	429 / 44.9	955 / 100.0

The extent to which students are encouraged to guess

RAW CHI SQUARE = 73.84273 WITH 3 DEGREES OF FREEDOM. SIGNIFICANCE = .0000

PROGRESS	GRTEACH: Primary (1)	GRTEACH: Interm (2)	ROW TOTAL
1 Yes	172	267	439
ROW PCT	39.2	60.8	45.3
COL PCT	32.2	61.2	
TOT PCT	17.7	27.5	
2 No	362	169	531
ROW PCT	68.2	31.8	54.7
COL PCT	67.8	38.8	
TOT PCT	37.3	17.4	
COLUMN TOTAL	534	436	970
	55.1	44.9	100.0

Use of homework assignments to measure students' progress

CORRECTED CHI SQUARE = 80.47165 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .00
RAW CHI SQUARE = 81.63916 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .00

TRAIN7	GRTEACH: Primary (1)	GRTEACH: Interm (2)	ROW TOTAL
1 Yes	233	140	373
ROW PCT	62.5	37.5	65.8
COL PCT	71.3	58.3	
TOT PCT	41.1	24.7	
2 No	94	100	194
ROW PCT	48.5	51.5	34.2
COL PCT	28.7	41.7	
TOT PCT	16.6	17.6	
COLUMN TOTAL	327	240	567
	57.7	42.3	100.0

Additional training in the area of remedial techniques is desired

CORRECTED CHI SQUARE = 9.69972 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .0
RAW CHI SQUARE = 10.26573 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .0

TRAIN9	GRTEACH: Primary (1)	GRTEACH: Interm (2)	ROW TOTAL
1 Yes	122	114	236
ROW PCT	51.7	48.3	41.8
COL PCT	37.4	47.7	
TOT PCT	21.6	20.2	
2 No	204	125	329
ROW PCT	62.0	38.0	58.2
COL PCT	62.6	52.3	
TOT PCT	36.1	22.1	
COLUMN TOTAL	326	239	565
	57.7	42.3	100.0

Additional training in the area of logic and reasoning is desired

CORRECTED CHI SQUARE = 5.37126 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .018
RAW CHI SQUARE = 5.98627 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .014

BEST COPY AVAILABLE

BEST COPY AVAILABLE

TRAIN11		GRTEACH Primary 1	Interm 2	ROW TOTAL
Yes	1	221 61.0 67.8 39.1	141 39.0 59.0 25.0	362 64.1
No	2	105 51.7 32.2 18.6	98 48.3 41.0 17.3	203 35.9
COLUMN TOTAL		326 57.7	239 42.3	565 100.0

Additional training in the area of enrichment programs is desired

CORRECTED CHI SQUARE = 4.26015 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .03
RAW CHI SQUARE = 4.63436 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .03

APPENDIX E

TABLES REPORTING RESULTS OBTAINED FOR RESEARCH QUESTION 4 :

How do teachers feel about math?

Table 1. Teachers' Perceptions Regarding Math*

Statement	Grade 1	2	3	4	5	6	Overall
Mathematics has contributed greatly to society.	3.67	3.69	3.65	3.72	3.68	3.72	3.68
Mathematics has contributed greatly to science and other fields of knowledge.	3.82	3.89	3.84	3.87	3.82	3.90	3.85
Mathematics helps develop a person's ability to think logically.	3.54	3.50	3.55	3.69	3.56	3.69	3.59
An understanding of mathematics is needed by artists and writers, as well as scientists.	3.30	3.34	3.19	3.37	3.29	3.22	3.30
I am comfortable teaching mathematics.	3.45	3.41	3.39	3.54	3.53	3.57	3.48
I teach mathematics in much the same way that mathematics was taught to me in elementary school.	2.07	2.07	2.14	2.35	2.41	2.22	2.20
Parents in this community value the study of mathematics.	3.14	3.14	3.09	3.18	3.17	3.18	3.14
I am comfortable adjusting the mathematics curriculum to meet the needs of more able students.	3.34	3.32	3.23	3.29	3.25	3.27	3.31
A person's career/vocational choices are influenced by their math achievement.	3.07	3.15	3.24	3.33	3.24	3.18	3.21
The majority of my students seem to enjoy learning math.	3.28	3.25	3.20	3.20	3.20	2.99	3.20
I feel comfortable teaching math concepts.	3.39	3.37	3.36	3.41	3.33	3.43	3.39
I feel comfortable teaching problem solving in math.	3.19	3.19	3.21	3.24	3.07	3.29	3.21
I am more comfortable teaching mathematics than I am teaching other subjects.	2.34	2.43	2.59	2.72	2.76	2.63	2.59

*Based on a four point scale where 4 = strongly agree, 3 = agree, 2 = disagree, and 1 = strongly disagree.

APPENDIX F

TABLES REPORTING RESULTS OBTAINED FOR RESEARCH QUESTION 5 :

How well are teachers prepared to teach math?

Table 7. The Number and Percent of Teachers Who Have Attended an Inservice or Workshop on Math Education Within the Last Five Years

	Grade						
	1	2	3	4	5	6	Overall
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
YES	84 (52)	73 (57)	74 (51)	57 (43)	54 (42)	47 (44)	467 (50)
NO	78 (48)	56 (43)	72 (49)	75 (57)	73 (57)	60 (56)	467 (50)

Table 8. The Gender of Teachers Across Grade Levels

	Grade						
	1	2	3	4	5	6	Overall
Response	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Male	5 (3)	12 (9)	27 (18)	40 (30)	51 (38)	56 (51)	230 (24)
Female	164 (97)	122 (91)	119 (82)	95 (70)	77 (60)	52 (48)	724 (76)

Table 1. The Average Number of Years Teachers Have Taught Elementary Math

	Grade						
	1	2	3	4	5	6	Overall
Years	13.38	12.21	11.76	12.54	13.16	13.34	12.54

Table 2. The Number and Percent of Teachers Who Majored in Either Science or Math

	Grade						
Response	1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
Major	2 (1)	4 (3)	7 (5)	8 (6)	5 (4)	12 (11)	52 (5)
Minor	14 (8)	13 (9)	17 (12)	21 (17)	10 (8)	20 (19)	105 (11)

Table 3. The Number and Percent of Teachers Who Have Obtained Their Masters Degree

	Grade						
	1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
YES	36 (21)	21 (16)	25 (17)	35 (26)	38 (30)	32 (29)	221 (23)
NO	131 (78)	114 (84)	122 (83)	97 (74)	87 (69)	77 (71)	727 (76)

Table 4. The Average Number of Courses in Math Completed by Teachers in Undergraduate Degree Program, the Average Number of Those Courses that Related to Methods of Teaching, and the Average Number of Courses in Math Completed at the Masters Level

	Grade						
	1	2	3	4	5	6	Overall
Average number of undergraduate courses	2.41	2.65	2.37	2.50	3.06	2.72	2.68
Average number of courses in methods of teaching math.	1.27	1.22	1.10	1.24	1.06	.96	1.14
Average number of graduate courses in math.	1.47	1.29	1.26	1.20	1.24	1.03	1.29

Table 5. Whether Teachers Perceived the Training They Received Regarding Elementary Math Was Adequate

	Grade						
	1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
YES	77 (46)	49 (36)	57 (39)	62 (47)	56 (45)	48 (46)	398 (42)
NO	91 (54)	86 (63)	90 (61)	70 (53)	67 (54)	57 (54)	545 (58)

BEST COPY AVAILABLE

Table 6. The Number and Percent of Teachers Who Perceived a Need for Further Training in Various Aspects of Elementary Math

Aspects of Elementary Math	Grade 1 No. (%)	2 No. (%)	3 No. (%)	4 No. (%)	5 No. (%)	6 No. (%)	Overall No. (%)
Math concepts	42 (25)	42 (29)	34 (22)	37 (26)	22 (16)	19 (16)	238 (24)
Problem solving skills	53 (31)	51 (25)	52 (34)	43 (30)	42 (31)	37 (32)	338 (34)
Geometry/ measurement	12 (7)	17 (12)	13 (9)	8 (6)	14 (10)	116 (14)	101 (10)
Using computers	47 (27)	55 (38)	54 (36)	49 (35)	42 (31)	30 (26)	319 (32)
Mainstreaming	19 (11)	20 (14)	29 (19)	15 (11)	20 (15)	15 (13)	137 (14)
Teaching math methodologies	26 (15)	32 (22)	22 (14)	23 (16)	22 (16)	23 (20)	176 (18)
Remedial techniques	71 (41)	64 (44)	69 (45)	47 (33)	49 (36)	31 (27)	382 (38)
Computation skills	21 (12)	28 (19)	18 (12)	19 (13)	19 (14)	13 (11)	138 (14)
Logic and reasoning	43 (25)	28 (19)	30 (20)	33 (23)	37 (27)	29 (25)	246 (25)
Using calculators	14 (8)	15 (10)	126 (17)	21 (15)	120 (15)	119 (16)	139 (14)
Enrichment program	71 (41)	163 (44)	65 (43)	50 (35)	41 (30)	34 (29)	373 (37)
Diagnosing students' math errors	47 (27)	39 (27)	51 (34)	30 (21)	39 (29)	30 (26)	273 (27)
Other	8 (5)	7 (5)	7 (5)	5 (3)	4 (3)	8 (7)	45 (4)

APPENDIX G

TABLES REPORTING RESULTS OBTAINED FOR RESEARCH QUESTION 6 :

How are math curriculums being implemented at the building level?

Table 1. Predominant Mode of Teaching Math

Teaching Mode	No. (%)
Teachers specializing in math	3 (3)
Team teachers across grade levels	0
Team teachers within grade level	15 (13)
Self-contained classroom teaching	95 (81)
Other	1 ( )

Table 2. Availability of Teacher Inservice in Math

	YES	NO
Teacher Inservice	No. (%)	No. (%)
Do teachers have continual access to inservice or staff development in math?	31 (26)	84 (72)
Have teachers in building had a building or District wide workshop in math within the last three years?	43 (27)	73 (62)

Table 3. Perceived Strength of the Math Curriculum Relative to Other Subject Areas

A Strength	About Average	A Weakness
No. (%)	No. (%)	No. (%)
20 (17)	84 (72)	12 (10)

Table 4. The Administrative Standardized Tests to Measure Student Progress

Tests Administered	No. (%)
Building level only	20 (17)
District level only	65 (56)
Both building and District level	31 (26)

Table 5. The Extent to Which Standardized Test Data are Used*

	X	Md.
To identify topics for math inservice or workshop	1.95	1.81
To inform parents how well their child is achieving	3.65	3.68
To identify needed changes in math instruction	3.48	3.57

*Based on a five point scale where 5 = extensively and 1 = not at all

Table 6. Principals' Perceptions of How Well 3rd Grade SLOs Match the CAT (statewide test administered to all 4th grade students in the month of October)

	No. (%)
Excellent	3 (3)
Good	30 26
Moderate	54 (46)
Low	22 (19)
Don't know	8 (7)

Table 7. Principals' Perception of How the 4th Grade CAT Scores Compare to National Percentile Scores for Other Grade Levels

Tests Administered	No. (%)
Above	8 (8)
About the same	82 (78)
Below	15 (14)

Table 8. The Percent of School Population Falling in Various Economic Categories for the Four District Sizes

Economic Category	Size A %	Size B %	Size C %	Size D %
Professionals & managers (physicians, lawyers, engineers, executives)	11	13	11	20
Children of white-collar workers (other than the above)	16	19	24	19
Skilled workers (electricians, carpenters, factory workers	30	26	30	24
Unskilled workers (laborers, custodians, dishwashers)	28	25	19	20
Unemployed	20	16	17	24

APPENDIX H

TABLES REPORTING RESULTS FOR QUESTION 7:

What is the relationship between grouping patterns, perceived student ability and instructional procedures?

Grouping Code: 1 = small groups with similar skills
2 = large group with similar skills
3 = large group with mixed skills

CURTYPE3	GROUPING 1	2	3	ROW TOTAL
0 Do not use	13	31	35	79
	16.5	39.2	44.3	8.7
	8.1	9.0	8.8	
	1.4	3.4	3.9	
1 Use as a Primary Source	47	111	85	243
	19.3	45.7	35.0	26.9
	29.4	32.1	21.4	
	5.2	12.3	9.4	
2 Use as a Supplemental Source	100	204	278	582
	17.2	35.1	47.8	64.4
	62.5	59.0	69.8	
	11.1	22.6	30.8	
COLUMN TOTAL	160	346	398	904
	17.7	38.3	44.0	100.0

The use of skill sheets

RAW CHI SQUARE = 11.97482 WITH 4 DEGREES OF FREEDOM. SIGNIFICANCE = .017

TEAMTCH	GROUPING 1	2	3	ROW TOTAL
1 Yes	21	77	25	123
	17.1	62.6	20.3	13.7
	13.2	22.4	6.3	
	2.3	8.6	2.8	
2 No	138	267	371	776
	17.8	34.4	47.8	86.3
	86.8	77.6	93.7	
	15.4	29.7	41.3	
COLUMN TOTAL	159	344	396	899
	17.7	38.3	44.0	100.0

The use of team teaching

RAW CHI SQUARE = 40.29350 WITH 2 DEGREES OF FREEDOM. SIGNIFICANCE = .00

BEST COPY AVAILABLE

BEST COPY AVAILABLE

ENRICH	COUNT / ROW PCT / COL PCT / TOT PCT	GROUPING 1	2	3	ROW TOTAL
Yes	1	144	292	310	746
		19.3	39.1	41.6	84.5
		91.1	86.6	79.9	
		16.3	33.1	35.1	
No	2	14	45	78	137
		10.2	32.8	56.9	15.5
		8.9	13.4	20.1	
		1.6	5.1	8.8	
COLUMN TOTAL		158	337	388	883
		17.9	38.2	43.9	100.0

The use of enrichment activities in the classroom

RAW CHI SQUARE = 12.76983 WITH 2 DEGREES OF FREEDOM. SIGNIFICANCE = .0(

PROGRES1	COUNT / ROW PCT / COL PCT / TOT PCT	GROUPING 1	2	3	ROW TOTAL
Yes	1	67	98	104	269
		24.9	36.4	38.7	29.8
		41.9	28.5	26.1	
		7.4	10.9	11.5	
No	2	93	246	294	633
		14.7	38.9	46.4	70.2
		58.1	71.5	73.9	
		10.3	27.3	32.6	
COLUMN TOTAL		160	344	398	902
		17.7	38.1	44.1	100.0

The use of standardized tests to measure student progress

RAW CHI SQUARE = 13.98984 WITH 2 DEGREES OF FREEDOM. SIGNIFICANCE = .0

PROGRES5	COUNT / ROW PCT / COL PCT / TOT PCT	GROUPING 1	2	3	ROW TOTAL
Yes	1	90	158	162	410
		22.0	38.5	39.5	45.5
		56.3	45.9	40.8	
		10.0	17.5	18.0	
No	2	70	186	235	491
		14.3	37.9	47.9	54.5
		43.8	54.1	59.2	
		7.8	20.6	26.1	
COLUMN TOTAL		160	344	397	901
		17.8	38.2	44.1	100.0

The use of homework assignments to measure student progress

RAW CHI SQUARE = 11.00931 WITH 2 DEGREES OF FREEDOM. SIGNIFICANCE = .004

BEST COPY AVAILABLE

FREQ02	GROUPING 1	2	3	ROW TOTAL	
0 Do not use	97	212	263	572	
	17.0	37.1	46.0	63.3	
	60.6	61.3	66.1		
	10.7	23.5	29.1		
1 Use less than once/ 2 wks	18	56	64	138	Assign homework for concept discovery
	13.0	40.6	46.4	15.3	
	11.3	16.2	16.1		
	2.0	6.2	7.1		
2 Use weekly or bi-weekly	35	45	45	125	
	28.0	36.0	36.0	13.8	
	21.9	13.0	11.3		
	3.9	5.0	5.0		
3 Use at least 2 times/wk	10	33	26	69	
	14.5	47.8	37.7	7.6	
	6.3	9.5	6.5		
	1.1	3.7	2.9		
COLUMN TOTAL	160	346	398	904	
	17.7	38.3	44.0	100.0	

RAW CHI SQUARE = 15.11544 WITH 6 DEGREES OF FREEDOM. SIGNIFICANCE = .019

FREQ15	GROUPING 1	2	3	ROW TOTAL	
0 Do not use	17	14	12	43	
	39.5	32.6	27.9	4.8	
	10.6	4.0	3.0		
	1.9	1.5	1.3		
1 Use less than once/2 wks	5	30	24	59	Drill basic facts
	8.5	50.8	40.7	6.5	
	3.1	8.7	6.0		
	.6	3.3	2.7		
2 Use weekly or bi-weekly	34	98	100	232	
	14.7	42.2	43.1	25.7	
	21.3	28.3	25.1		
	3.8	10.8	11.1		
3 use at least 2 times/wk	104	204	262	570	
	18.2	35.8	46.0	63.1	
	65.0	59.0	65.8		
	11.5	22.6	29.0		
COLUMN TOTAL	160	346	398	904	
	17.7	38.3	44.0	100.0	

RAW CHI SQUARE = 23.62799 WITH 6 DEGREES OF FREEDOM SIGNIFICANCE = .000

BEST COPY AVAILABLE

FREQ23	COUNT / ROW PCT / COL PCT / TOT PCT	GROUPING 1	2	3	ROW TOTAL	
0 Do not use		108 16.4 67.5 11.9	262 39.8 75.7 29.0	288 43.8 72.4 31.9	658 72.8	
1 Use less than once/ 2 wks		20 15.2 12.5 2.2	48 36.4 13.9 5.3	64 48.5 16.1 7.1	132 14.6	Use computers to learn math concepts
2 Use weekly or bi-weekly		20 25.0 12.5 2.2	27 33.8 7.8 3.0	33 41.3 8.3 3.7	80 8.8	
3 Use at least 2 times/wk		12 35.3 7.5 1.3	9 26.5 2.6 1.0	13 38.2 3.3 1.4	34 3.8	
COLUMN TOTAL		160 17.7	346 38.3	398 44.0	904 100.0	

RAW CHI SQUARE = 12.66088 WITH 6 DEGREES OF FREEDOM. SIGNIFICANCE = .048

Q37	COUNT / ROW PCT / COL PCT / TOT PCT	GROUPING 1	2	3	ROW TOTAL	
1 Disagree		7 10.4 4.7 .8	20 29.9 6.1 2.4	40 59.7 10.7 4.7	67 7.9	I am comfortable adusting the math curriculum to meet the needs of more able students
2 Agree		142 18.1 95.3 16.7	308 39.3 93.9 36.2	333 42.5 89.3 39.2	783 92.1	
COLUMN TOTAL		149 17.5	328 38.6	373 43.9	850 100.0	

RAW CHI SQUARE = 7.66748 WITH 2 DEGREES OF FREEDOM. SIGNIFICANCE = .021

APPENDIX I

TABLES REPORTING RESULTS FOR RESEARCH QUESTION 9:

Is there a significant difference among schools from different size districts relative to curriculum development, math instruction, and math achievement?

Code for district size enrollments:

Size A = 01 to 2000
Size B = 2001 to 7000
Size C = 7001 to 14000
Size D = over 14000

BEST COPY AVAILABLE

SIZE

SL01		1	2	3	4	ROW TOTAL
District Administration	1	14	16	20	40	90
		15.6	17.8	22.2	44.4	10.0
		6.6	6.3	8.5	20.2	
		1.6	1.8	2.2	4.5	
District teacher curriculum com.	2	95	194	198	144	631
		15.1	30.7	31.4	22.8	70.4
		45.0	76.7	84.6	72.7	
		10.6	21.7	22.1	16.1	
building or indiv. teacher recommendations	3	102	43	16	14	175
		58.3	24.6	9.1	8.0	19.5
		48.3	17.0	6.8	7.1	
		11.4	4.8	1.8	1.6	
COLUMN TOTAL		211	253	234	198	896
		23.5	28.2	26.1	22.1	100.0

How the SLOs were developed in the district

RAW CHI SQUARE = 179.91101 WITH 6 DEGREES OF FREEDOM. SIGNIFICANCE = .0000

SIZE

SL02		1	2	3	4	ROW TOTAL
Yes	1	156	104	49	26	335
		46.6	31.0	14.6	7.8	33.9
		64.5	39.4	19.1	11.5	
		15.8	10.5	5.0	2.6	
No	2	86	160	207	201	654
		13.1	24.5	31.7	30.7	66.1
		35.5	60.6	80.9	88.5	
		8.7	16.2	20.9	20.3	
COLUMN TOTAL		242	264	256	227	989
		24.5	26.7	25.9	23.0	100.0

Teacher involvement in developing the SLOs

RAW CHI SQUARE = 180.43320 WITH 3 DEGREES OF FREEDOM. SIGNIFICANCE = .00

SIZE

CUR2		1	2	3	4	ROW TOTAL
Building or Individ. teacher recommendation	3	90	50	8	27	175
		51.4	28.6	4.6	15.4	19.7
		41.7	21.5	3.3	13.6	
		10.1	5.6	.9	3.0	
District teacher curriculum com.	4	120	161	211	142	634
		18.9	25.4	33.3	22.4	71.2
		55.6	69.1	86.8	71.7	
		13.5	18.1	23.7	16.0	
District Administration	5	6	22	24	29	81
		7.4	27.2	29.6	35.8	9.1
		2.8	9.4	9.9	14.6	
		.7	2.5	2.7	3.3	
COLUMN TOTAL		216	233	243	198	890
		24.3	26.2	27.3	22.2	100.0

How the math curriculum materials were selected in the district

RAW CHI SQUARE = 122.62386 WITH 6 DEGREES OF FREEDOM. SIGNIFICANCE = .000

BEST COPY AVAILABLE

CUR3	SIZE 1	2	3	4	ROW TOTAL
1 Yes	128	75	40	44	287
	44.6	26.1	13.9	15.3	30.0
	54.9	29.9	15.8	20.1	
	13.4	7.8	4.2	4.6	
2 No	105	176	213	175	669
	15.7	26.3	31.8	26.2	70.0
	45.1	70.1	84.2	79.9	
	11.0	18.4	22.3	18.3	
COLUMN TOTAL	233	251	253	219	956
	24.4	26.3	26.5	22.9	100.0

Teacher involvement in the selection of the math materials

RAW CHI SQUARE = 103.44551 WITH 3 DEGREES OF FREEDOM. SIGNIFICANCE = .000

FREQ21	SIZE 1	2	3	4	ROW TOTAL
0 Do not use	144	168	135	152	599
	24.0	28.0	22.5	25.4	60.0
	59.3	62.7	52.3	66.1	
	14.4	16.8	13.5	15.2	
1 less than once/2 wks	44	54	55	42	195
	22.6	27.7	28.2	21.5	19.5
	18.1	20.1	21.3	18.3	
	4.4	5.4	5.5	4.2	
2 weekly or bi-weekly	31	33	56	17	137
	22.6	24.1	40.9	12.4	13.7
	12.8	12.3	21.7	7.4	
	3.1	3.3	5.6	1.7	
3 at least 2 times/wk	24	13	12	19	68
	35.3	19.1	17.6	27.9	6.8
	9.9	4.9	4.7	8.3	
	2.4	1.3	1.2	1.9	
COLUMN TOTAL	243	268	258	230	999
	24.3	26.8	25.8	23.0	100.0

Use computers for math games

RAW CHI SQUARE = 31.82816 WITH 9 DEGREES OF FREEDOM. SIGNIFICANCE = .0003

PROGRES1	SIZE 1	2	3	4	ROW TOTAL
1 Yes	94	89	52	68	303
	31.0	29.4	17.2	22.4	30.5
	38.8	33.3	20.2	29.8	
	9.4	8.9	5.2	6.8	
2 No	148	178	206	160	692
	21.4	25.7	29.8	23.1	69.5
	61.2	66.7	79.8	70.2	
	14.9	17.9	20.7	16.1	
COLUMN TOTAL	242	267	258	228	995
	24.3	26.8	25.9	22.9	100.0

Teacher use of standardized tests to measure student progress

RAW CHI SQUARE = 22.05045 WITH 3 DEGREES OF FREEDOM. SIGNIFICANCE = .00

BEST COPY AVAILABLE

PROGRES2		SIZE 1	2	3	4	ROW TOTAL	
1 Yes	COUNT	17	92	78	55	242	Use of district developed tests to measure student progress
	ROW PCT	7.0	38.0	32.2	22.7	24.3	
	COL PCT	7.0	34.5	30.2	24.1		
	TOT PCT	1.7	9.2	7.8	5.5		
2 No	COUNT	225	175	180	173	753	
	ROW PCT	29.9	23.2	23.9	23.0	75.7	
	COL PCT	93.0	65.5	69.8	75.9		
	TOT PCT	22.6	17.6	18.1	17.4		
COLUMN TOTAL		242 24.3	267 26.8	258 25.9	228 22.9	995 100.0	

RAW CHI SQUARE = 59.13898 WITH 3 DFGREES OF FREEDOM. SIGNIFICANCE = .00

PROGRES3		SIZE 1	2	3	4	ROW TOTAL	
1 YES	COUNT	27	26	19	9	81	Use of building developed tests to measure student progress
	ROW PCT	33.3	32.1	23.5	11.1	8.1	
	COL PCT	11.2	9.7	7.4	3.9		
	TOT PCT	2.7	2.6	1.9	.9		
2 NO	COUNT	214	241	239	219	913	
	ROW PCT	23.4	26.4	26.2	24.0	91.9	
	COL PCT	88.8	90.3	92.6	96.1		
	TOT PCT	21.5	24.2	24.0	22.0		
COLUMN TOTAL		241 24.2	267 26.9	258 26.0	228 22.9	994 100.0	

RAW CHI SQUARE = 9.49406 WITH 3 DEGREES OF FREEDOM. SIGNIFICANCE = .0

PROGRES4		SIZE 1	2	3	4	ROW TOTAL	
1 Yes	COUNT	223	216	220	192	851	Use of text book tests to measure student progress
	ROW PCT	26.2	25.4	25.9	22.6	85.5	
	COL PCT	92.1	80.9	85.3	84.2		
	TOT PCT	22.4	21.7	22.1	19.3		
2 No	COUNT	19	51	38	36	144	
	ROW PCT	13.2	35.4	26.4	25.0	14.5	
	COL PCT	7.9	19.1	14.7	15.8		
	TOT PCT	1.9	5.1	3.8	3.6		
COLUMN TOTAL		242 24.3	267 26.8	258 25.9	228 22.9	995 100.0	

RAW CHI SQUARE = 13.52590 WITH 3 DEGREES OF FREEDOM. SIGNIFICANCE = .0

BEST COPY AVAILABLE

PROGRESS	SIZE 1	2	3	4	ROW TOTAL
1 Yes	114	119	100	117	450
	25.3	26.4	22.2	26.0	45.3
	47.3	44.6	38.8	51.3	
	11.5	12.0	10.1	11.8	
2 No	127	148	158	111	544
	23.3	27.2	29.0	20.4	54.7
	52.7	55.4	61.2	48.7	
	12.8	14.9	15.9	11.2	
COLUMN TOTAL	241	267	258	228	994
	24.2	26.9	26.0	22.9	100.0

Use of homework assignments to measure student progress

RAW CHI SQUARE = 8.23199 WITH 3 DEGREES OF FREEDOM. SIGNIFICANCE = .0415

ATTEND	SIZE 1	2	3	4	ROW TOTAL
1 Yes	96	114	125	132	467
	20.6	24.4	26.8	28.3	50.0
	42.3	45.6	51.7	61.4	
	10.3	12.2	13.4	14.1	
2 No	131	136	117	83	467
	28.1	29.1	25.1	17.8	50.0
	57.7	54.4	48.3	38.6	
	14.0	14.6	12.5	8.9	
COLUMN TOTAL	227	250	242	215	934
	24.3	26.8	25.9	23.0	100.0

Whether teachers have attended a mathematics inservice within the last five years.

RAW CHI SQUARE = 18.76438 WITH 3 DEGREES OF FREEDOM. SIGNIFICANCE = .0003

GENDER	SIZE 1	2	3	4	ROW TOTAL
1 Male	73	57	57	43	230
	31.7	24.8	24.8	18.7	24.1
	31.1	22.4	23.3	19.5	
	7.7	6.0	6.0	4.5	
2 Female	162	197	188	177	724
	22.4	27.2	26.0	24.4	75.9
	68.9	77.6	76.7	80.5	
	17.0	20.6	19.7	18.6	
COLUMN TOTAL	235	254	245	220	954
	24.6	26.6	25.7	23.1	100.0

Teachers gender

RAW CHI SQUARE = 9.19828 WITH 3 DEGREES OF FREEDOM. SIGNIFICANCE = .026

BEST COPY AVAILABLE

FREQ21	SIZE 1	2	3	4	ROW TOTAL
0 Do not use	144	168	135	152	599
	24.0	28.0	22.5	25.4	60.0
	59.3	62.7	52.3	66.1	
	14.4	16.8	13.5	15.2	
1 less than once/ 2 wks	44	54	55	42	195
	22.6	27.7	28.2	21.5	19.5
	18.1	20.1	21.3	18.3	
	4.4	5.4	5.5	4.2	
2 weekly or bi-weekly	55	46	68	36	205
	26.8	22.4	33.2	17.6	20.5
	22.6	17.2	26.4	15.7	
	5.5	4.6	6.8	3.6	
COLUMN TOTAL	243	268	258	230	999
	24.3	26.8	25.8	23.0	100.0

RAW CHI SQUARE = 14.15575 WITH 6 DEGREES OF FREEDOM. SIGNIFICANCE = .02

FOURTH	SIZE 1	2	3	4	ROW TOTAL
1 Low Achieving Schools	37	42	14	64	157
	23.6	26.8	8.9	40.8	49.7
	47.4	60.9	17.1	73.6	
	11.7	13.3	4.4	20.3	
2 High Achieving Schools	41	27	68	23	159
	25.8	17.0	42.8	14.5	50.3
	52.6	39.1	82.9	26.4	
	13.0	8.5	21.5	7.3	
COLUMN TOTAL	78	69	82	87	316
	24.7	21.8	25.9	27.5	100.0

RAW CHI SQUARE = 58.33849 WITH 3 DEGREES OF FREEDOM. SIGNIFICANCE = .0001

APPENDIX J

TABLES REPORTING RESULTS FOR QUESTION 10:

Is there a significant difference between high and low achieving schools relative to curriculum development and math instruction?

BEST COPY AVAILABLE

GROUPING	FOURTH: Low (1)	FOURTH: High (2)	ROW TOTAL
1 Small groups similar skills	20	28	48
	41.7	58.3	17.0
	14.3	19.6	
	7.1	9.9	
2 Large group with similar skills	65	44	109
	59.6	40.4	38.5
	46.4	30.8	
	23.0	15.5	
3 Large group with varied skills	55	71	126
	43.7	56.3	44.5
	39.3	49.7	
	19.4	25.1	
COLUMN TOTAL	140	143	283
	49.5	50.5	100.0

Kind of grouping pattern used

RAW CHI SQUARE = 7.37998 WITH 2 DEGREES OF FREEDOM. SIGNIFICANCE = .025(

PROGRES1	FOURTH: Low (1)	FOURTH: High (2)	ROW TOTAL
1 Yes	35	64	99
	35.4	64.6	31.4
	22.4	40.3	
	11.1	20.3	
2 No	121	95	216
	56.0	44.0	68.6
	77.6	59.7	
	38.4	30.2	
COLUMN TOTAL	156	159	315
	49.5	50.5	100.0

The use of standardized tests to measure student progress

CORRECTED CHI SQUARE = 10.78512 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .001
RAW CHI SQUARE = 11.59706 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .000(

PROGRESS	FOURTH: Low (1)	FOURTH: High (2)	ROW TOTAL
1 Yes	86	69	155
	55.5	44.5	49.4
	55.5	43.4	
	27.4	22.0	
2 No	69	90	159
	43.4	56.6	50.6
	44.5	56.6	
	22.0	28.7	
COLUMN TOTAL	155	159	314
	49.4	50.6	100.0

The use of homework assignments to measure student progress

CORRECTED CHI SQUARE = 4.11705 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .04
RAW CHI SQUARE = 4.58789 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = .03